STRUCTURAL TIMBER HAND BOOK

ON PACIFIC COAST WOODS

WEST COAST LUMBERMEN'S ASS'N

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PUBLISHED BY

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INTRODUCTION

The purpose of this book is to present information relative to structural timber which will be useful to engineers, architects, and contractors. Particular attention has been given to Pacific Coast species.

There have been published from time to time by the U. S. Forest Service and other organizations data showing the strength and durability of Pacific Coast timber. In writing this book an effort has been made to collect such of these data as are up to date and to present them in a concise form for general use.

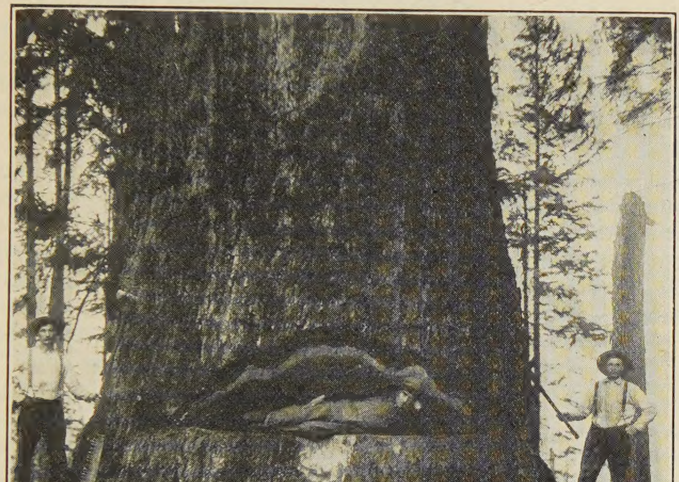
A brief description is given of the four principal species of wood found in Washington and Oregon, viz., Douglas Fir, Western Red Cedar, Western Hemlock and Sitka Spruce. This information may be of interest to those not entirely familiar with Pacific Coast conditions.

Many thousands of computations have been made in preparing the tables in this book. All computations have been cross-checked to eliminate possible errors. Tables show the safe total loads and corresponding deflections for rectangular beams of various sizes. The number of pounds per board foot of lumber, supported by beams, is also shown, which will assist in effecting economical designs. Tables have been computed which show the safe loads on beams limited by the horizontal shearing stress. Other tables show safe total loads on columns of various sizes and still other tables give the maximum spans for mill and laminated floors, board measure for various dimensions and lengths, and board measure and weight for unit lengths of Douglas fir dimension timber.

Data and figures are given on timber frame-brick mill buildings, showing costs, insurance rates, and details of construction. Standard formulas for computing stresses covering the usual practical conditions are given. A grading rule for securing structural timbers of high strength is also included.

A considerable amount of data is presented on the creosoting of Douglas fir lumber in various forms, such as bridge stringers, mine timbers, piling, ties, bridge caps, paving blocks, silo staves, and other forms. Space is devoted to wooden silos and red cedar shingles. Kiln drying lumber is briefly discussed as well as other subjects of interest to the consumer of wood.

Acknowledgment is herewith made of the able review of the manuscript of this book by Paul P. Whitham, Assoc. Mem. Am. Soc. C. E., Consulting Civil Engineer and former Chief Engineer, Port of Seattle, and Charles C. More, Assoc. Mem. Am. Soc. C. E., Professor of Civil Engineering, University of Washington, both of whom are men of wide experience in the use of structural timber.



A Giant Douglas Fir 17 Feet in Diameter.

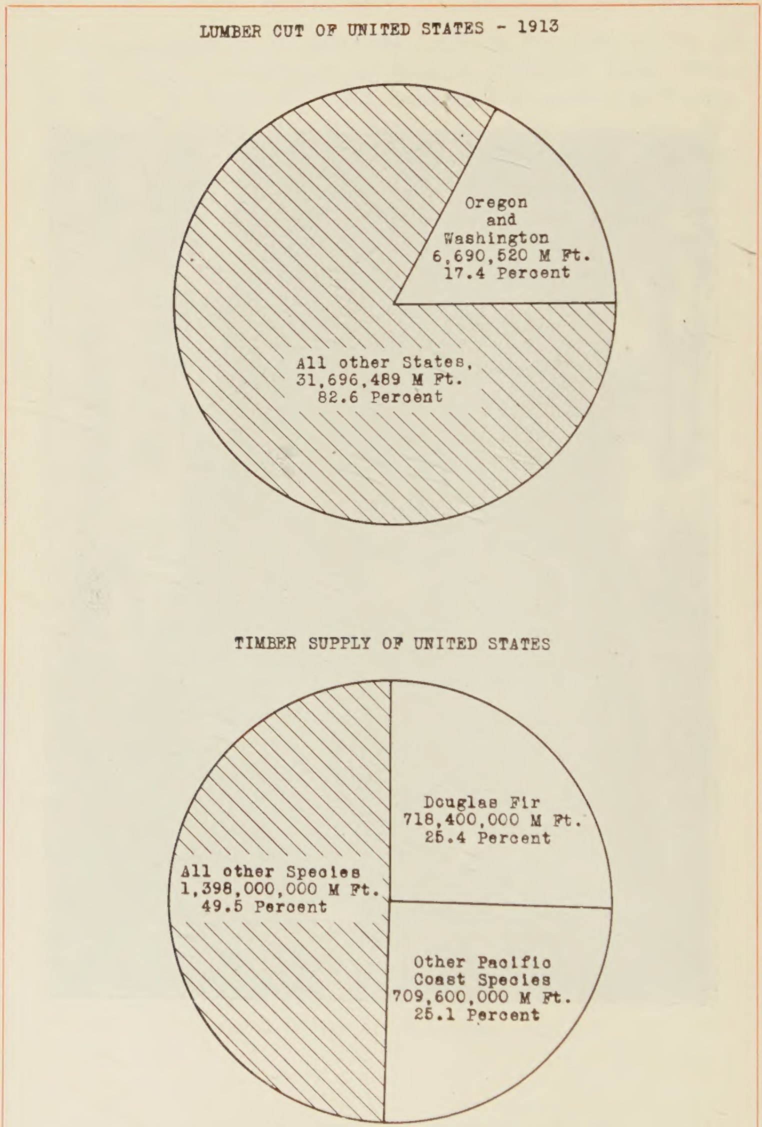


Fig. 1. Lumber cut of United States in 1913 and distribution of the standing timber supply.

PACIFIC COAST TIMBER

The largest and finest growth of timber in the world is found on the Pacific Coast. Figure 1 shows that Douglas fir, a single species, composes more than 25 per cent of the entire standing timber supply of the United States, including both softwoods and hardwoods.

The timber stand of Washington and Oregon is such as to insure a permanent source of supply of the highest class of lumber. The winter climate in this vast timber belt is very mild, enabling the lumber camps and mills to operate continuously, thereby producing a steady supply of manufactured products. Practically all log transportation is by water and many of the mills are located on tidewater. These conditions make possible the production of lumber at a minimum operating cost.

One of the most striking features of the timber supply of Washington and Oregon is the particularly large sizes of timbers which are available. Structural timbers of Douglas fir 18″x18″x120′ to 140′ in length may be had at any time and timbers 36″x36″x50′ to 80′ in length are as readily available. This gives some idea as to the possibilities in manufacturing structural forms from the huge logs available in these timber states.

Lumbering has for many years been the largest industry in the states of Washington and Oregon, and will continue to hold first place for many years to come. Statistics from the U. S. Department of Agriculture Bulletin No. 232 show the lumber cut of these states to have been 6,690,520,000 feet board measure in 1913. This cut amounted to 17.4 per cent of the total lumber cut in the United States in the same year. The lumber products of Washington and Oregon for 1913 were distributed to almost every part of the United States. Approximately 9 per cent were exported to foreign countries. The accompanying map (Fig. 2) was prepared by the U. S. Forest Service, Portland, Oregon, and shows the percentage of the lumber cut in Washington and Oregon in 1913 which was shipped to the various states. This wide distribution is accounted for by the fact that with Douglas Fir, Western Red Cedar, Western Hemlock and Sitka Spruce from which to select, it is possible to secure a material which will serve any use for which wood is adapted.

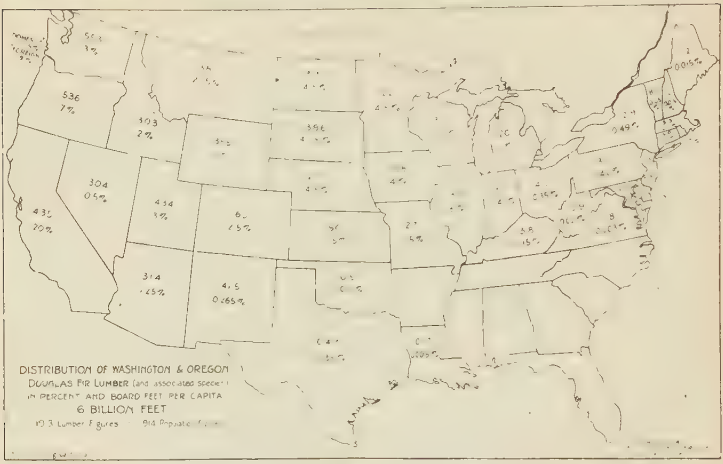


Fig. 2. Distribution of cut of Douglas Fir and associated species from the States of Washington and Oregon. Figures given in percentage of total cut, and in board feet per capita.

In order to give some idea of the uses to which these four species may best be placed, the following description may be of interest:

DOUGLAS FIR

(Pseudotsuga taxifolia)

Common names in use: Red fir, yellow fir, Oregon pine, Puget Sound pine and Douglas spruce.

The name Douglas fir has, however, recently been adopted by the U. S. Forest Service and is rapidly replacing other names previously used for this species.

Douglas fir is by far the most important of these species. It would be difficult to give a better general description of this wood than is found in the following quotations taken from U. S. Forest Service Bulletin No. 88.

"Douglas fir may, perhaps, be considered as the most important of American woods. Though in point of production it ranks second to southern yellow pine, its rapid growth in the Pacific Coast forests, its comparatively wide distribution and the great variety of uses to which its wood can be put, place it first. It is very extensively used in the building trades; by the railroads in the form of ties, piling, car and bridge material and by many of the manufacturing industries of the country. As a structural

timber it is not surpassed and probably it is most widely used and known in this capacity."

"Douglas fir is manufactured into almost every form known to the sawmill operator. A list of such forms and uses would represent many industries and would include piling and poles, mine timbers, railway ties, bridge and trestle timbers, timbers for car construction; practically all kinds of lumber for houses, material for the furniture maker and boat builder; special products for cooperage, tanks, paving blocks, boxes, and pulpwood; fuel; and a long line of miscellaneous commodities."

"Piling is extensively employed in harbor-improvement work and in preparing foundations in soft ground for bridges, trestles and other heavy structures. The long, straight, slightly tapering trunk of Douglas fir fits it for this use, and it is strong, resilient, and fairly durable. It has no important competitor as a pile timber in the western part of the United States, and is used almost exclusively for marine and railroad work on the Pacific Coast. The wood is sufficiently hard to penetrate readily most soils, and it acts well under the hammer. It is occasionally necessary to band the tops of piles to prevent brooming and splitting, but bands are used only where hard subsoils must be penetrated."

"Ties of Douglas fir are both sawed and hewed, though three-fourths are sawed. Those which are sawed are made both from second growth and from mature trees. About two-thirds of the ties supplied by the forests of the western part of the United States are of Douglas fir, the remaining one-third consisting chiefly of western yellow pine, lodgepole pine, redwood and western hemlock. Practically all the large sawmills in Washington and Oregon cut fir ties to order, and some small mills cut little or nothing else. It is customary to saw ties from a large portion of low-grade material obtained in the usual milling operations. Douglas fir generally yields about 25 per cent of high-grade lumber and the remaining 75 per cent must be worked into lower grade lumber, dimension products, timbers, and ties."

"Bridge and Trestle Timbers. Probably the Pacific Coast railroads use more Douglas fir than is consumed by any other single industry. Bridge and trestle timbers of the wood compare favorably in their structural merits with those from any other American species. They are light and strong, fairly resilient and durable, and can be had in any desired size or specification. In

trestles, fir is used in the round form for piling, and in dimension sizes for posts, caps, sills, ties, girts, and braces."

"CAR MATERIAL. Douglas fir car sills are used in the construction and repair of freight and passenger cars throughout the United States. Their strength, elasticity, durability, and the ease with which the wood may be worked make them preferable to all others. The wood is much employed in car building for purposes other than sills. In fact, it is used for nearly all purposes, except for draft-rigging supports, which are made of oak or maple. It is employed for siding, framing, flooring, roofing, and many other parts of passenger cars. Though the interior finish of cars is generally of hardwood, Douglas fir has been given place in some dining and private cars, because of the beauty of its grain."

"HOUSE CONSTRUCTION MATERIAL. For house construction Douglas fir is manufactured into all forms of dimension stock, and is used particularly for general building and construction purposes. Its strength and comparative lightness fit it for joists, floor beams, rafters, and other timbers which must carry loads. Occasionally entire buildings are constructed of it, and in some parts of the Pacific States it is practically the only common lumber used. The largest consumption is in Washington, California, Oregon, Utah, Idaho, and Colorado."

"FLOORING. The comparative hardness of the wood fits it for flooring, and it meets a large demand. Douglas fir edge-grain flooring is often considered superior to that made from any other American softwood, and it is used on the Pacific Coast to the exclusion of nearly all others."

"FINISH. Clear lumber, sawed flat grain, shows pleasing figures, and the contrast between the spring and summer wood has been considered as attractive as the grain of quarter-sawed oak. It takes stain well, and by staining, the beauty of the grain may be more strongly brought out, and a number of costly woods can be successfully imitated. Fir finish has been widely advertised, and the demand for it in the Eastern States, the Middle Western States, and in the Upper Mississippi Valley is rapidly increasing. Its chief use is for door and window casing, baseboards, and all kinds of panelwork. Practically all of the finish is used by the building trades, and the largest use naturally is near the points of production, though it is in great demand in Southern California and in Hawaii."

"PAVING BLOCKS. Paving blocks of Douglas fir, when given preservative treatment, are rapidly coming into use in municipal improvements. The wood's hardness and the comparative ease with which the blocks may be treated with creosote make it compare favorably with other paving woods. The blocks wear slowly under heavy traffic, are nearly noiseless, furnish fair toe hold to horses, are resilient, and are practically impervious to water. It is important, however, that they be thoroughly impregnated with preservative."

WESTERN RED CEDAR

(Thuja plicata)

Common names in use: Red cedar, Arborvitae, Western cedar, canoe cedar, and gigantic red cedar.

Western red cedar has certain individual qualifications which particularly fit it for certain purposes. The wood is soft and straight grained. It is especially suited for siding or any outside forms exposed to the weather since it has remarkable durability and holds paint and stains well. Red cedar is used for the construction of rowboats, canoes, motorboats, and similar small vessels. Having a low shrinkage factor, it readily resists alternate changes from wet to dry. Red cedar is cut extensively into shingles and for this use it has no equal. The life of the red cedar shingle is measured by its mechanical wear since it does not decay. Red cedar is a particularly favored wood for use in lining closets and making clothes chests. The odor of the wood is very pleasant, but it is objectionable to moths and similar insects.

Western red cedar is a beautiful wood to work since its grain is so uniform. It may be very smoothly finished and is beautiful for ceiling, paneling, or finishing in places where the wood is not subjected to hard wear.

Western red cedar is extensively used as a pole and post timber. It has the required strength for this use and its natural resistance to decay is responsible for its wide application in this field.

WESTERN HEMLOCK

(Tsuga heterophylla)

Common names in use: Hemlock, Western hemlock, Western hemlock fir, and Alaska pine.

As western hemlock is becoming better known it is gradually gaining a reputation as a distinctive wood, not to be confused in

its properties with other species of the same family. It is used extensively in building operations on the Pacific Coast and locally commands the same price as Douglas fir for this purpose. The following quotations are taken from U. S. Forest Service Bulletin 115 and give a fair idea of the merits and adaptability of this wood.

"Structural Uses. The demand for western hemlock both in the form of ordinary lumber and for special uses will no doubt increase when its properties are better known. At present it has a very poor market standing because of the prejudice against the name "hemlock." The lumber is practically free from pitch, has a handsome grain, takes paints and stains well, and works smoothly, both spring and summer wood standing up well to the cutting edge. It is at present manufactured into the common forms of lumber, and is also used for pulp, boxes, barrels, sash and door stock, fixtures, furniture and other special uses."

"Bridge and Trestle Timbers. Western hemlock is well suited for use in all but the heaviest construction work, as shown by results of the tests discussed in this bulletin; but up to the present it has had a limited use in bridges and trestles. It has been used in some instances for caisson construction."

"Crossties. A considerable amount of western hemlock is cut into crossties. Many of the western railroads use Douglas fir, western larch, redwood, and western hemlock almost exclusively for tie material."

"Poles and Piling. Occasionally western hemlock is cut into telephone or telegraph poles, but its use in this form has been very limited. It has the requisite strength for pole use and grows in such dimensions as to make it very suitable for this class of work. With a good butt treatment with some efficient preserving fluid it should give good service as a pole material."

"Though practically all piling in the Pacific Northwest is of Douglas fir, western hemlock is used to a limited extent, however, for this class of work and has apparently given satisfaction."

"Flooring. Western hemlock, when cut edge grain, makes an excellent flooring material. It finishes smoothly on account of the uniform texture of the wood and it also wears evenly. It is not suitable for use in damp places, on account of its tendency to warp under such conditions."

"INSIDE FINISHING. As a finish lumber western hemlock has the advantage of containing practically no pitch; it has a beautiful grain, works smoothly, takes stain readily, and, when properly dried, will not shrink or swell materially under normal conditions. It presents a comparatively hard surface and consequently does not mar easily."

"BARRELS AND BOXES. Western hemlock is used to a large extent for barrels and boxes for shipping foodstuffs. For this purpose it serves admirably, since the wood is odorless and tasteless. Its strength and lightness also add to its value for these uses. It has some tendency to split when nails are driven into it, but this fault may be largely overcome by the use of fine nails."

SITKA SPRUCE

(*Picea sitchensis*)

Common names in use: Tideland spruce, Great tideland spruce, and Western spruce.

The peculiar characteristics of spruce have obtained for it a wide variety of applications.

It is a very white, straight-grained wood of tough fiber, is entirely without taste or odor, and is of exceptionally light weight and extremely stiff. It is probably the stiffest softwood in the United States, in proportion to its weight.

It cuts to particular advantage for doors, window and door frames, mouldings, stepping, cornices, and is extensively used for bevel siding for house construction.

It is very desirable and economical for large doors, such as are used for garages, freight houses and similar structures.

Because of its entire lack of taste or odor it is unsurpassed for the manufacture of containers for shipping butter, meats and other food products, and it is given special preference for making refrigerators.

It is highly valued, and has a wide demand in the construction of pianos, organs, violins, guitars and mandolins.

Because of its stiffness, tough fiber, straight grain, and light weight, it has been given a prominent place in the building of aeroplanes.

Spruce has been used quite extensively in pontoon bridge construction. It is found to combine strength and lightness to the highest degree, and is easily transported from place to place, and is tough enough to stand rough usage.

MECHANICAL AND PHYSICAL PROPERTIES OF TIMBER

It is difficult to obtain a correct comparison of the strength properties of structural timbers, yet, from a practical point of view, structural sizes furnish the data sought by engineers and others to guide them in their designs.

In preparation of the following tables showing the various properties of structural timbers, every effort has been made to obtain the most up to date figures available. In all comparisons made consideration has been given to the size of the timbers, general quality, moisture condition and to other factors which affect the strength. Many publications have been issued from time to time containing values for structural timbers. In many cases the timbers have been unlike in grades and have varied materially in moisture content. Due to variations in such factors as mentioned, comparisons have been in many cases very misleading. This point has been recognized in preparing the following data and every effort has been made to eliminate comparisons which are not on the same basis.

VARIABILITY OF TIMBER

All species of timber show variations in weight and strength. These variations are considerable in some cases depending upon the quality of the clear wood as well as the grade and condition of seasoning of the timber. It is essential that the quality of the timbers of any species be determined by due consideration of these factors rather than locality of growth, etc. The density classification for Douglas fir timbers proposed on pages 31 to 33 is expected to eliminate to a large extent these variables and insure a product of uniform strength qualities.

BENDING STRENGTH OF LARGE STRINGERS

Tables 1 and 2 show results obtained from U. S. Forest Service Bulletin No. 108, pages 74 to 123. In order to make the comparison fair to all species approximately 30 per cent of the lowest tests were discarded, thus eliminating timbers with serious defects. This elimination is particularly necessary because of the fact that certain species were tested in many cases with large knots purposely placed on the tension face of the beam in order to determine the influence of such defects upon the strength. Douglas fir was the principal species used in studying the effect

TABLE 1

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS
GREEN MATERIAL
Taken from U. S Forest Service Bulletin 108.

Species	Cross Section under Test	No. of Tests	Rings per Inch	Moisture Content	Weight per Cu. Ft. Oven-dry	Fiber Stress at Elastic Limit per Sq. In.	Modulus of Rupture per Sq. In.	Modulus of Elasticity per Sq. In.	Relative Strength based on Modulus of Rupture. Douglas Fir=100 per cent	Relative Stiffness based on Modulus of Elasticity. Douglas Fir=100 per cent	Knots in Stringers Tested: Vol. I, Less than 1½ In.	Vol. I, 1½ In. and over	Vol. II, Less than 1½ In.	Vol. II, 1½ In. and over	Vol. III, Less than 1½ In.	Vol. III, 1½ In. and over
	Inches			Per Cent	Lbs.	Lbs.	Lbs.	1000 lbs.	Per Cent	Per Cent						
Douglas Fir	8x16	134	10.9	31.8	28.9 (132)	4282 (133)	6605	1611	100.0	100.0	1.2	0.5	1.7	0.7	10.0	3.3
Long-leaf Pine	12x12 10x16 8x16 6x16 6x10	13	14.6 (12)	29.2	35.4	3855	6437	1466	97.4	91.0	0.4	0.2	0.5	0.2	4.0	1.1
Short-leaf Pine	8x16 8x14 8x12	33	12.3	48.4	31.4	3376 (31)	5948	1546 (31)	90.0	96.0	0.4	0.1	0.1	0.1	2.4	1.2
Western Hemlock	8x16	27	17.6	41.9	28.1	3761	5821	1489	88.1	92.4	0.7	0.7	1.5	0.4	3.4	2.3
Loblolly Pine	8x16 5x12	78	6.2 (68)	58.0 (55)	31.2 (55)	3266	5568	1467	84.4	91.1	0.2	0.2	0.3	0.7	4.6	3.7
Western Larch	8x16 8x12	43	23.9	50.5	28.7	3677	5562	1364	84.2	84.6	0.9	0.2	2.3	0.6	10.9	1.3
Redwood	8x16 6x12 7x 9	30	19.5	90.2	23.3	4323	5327	1202	80.6	74.6	0.9	0.1	1.6	1.3	8.3	3.6
Tamarack	6x12	11	16.7	56.9	29.3	3231	4984	1268	75.5	78.7	0.9	0.4	1.4	0.4	8.4	0.7
Norway Pine	6x12	11	13 2	52.1	25.2	2397	3767	1042	57.0	64.7	2.5	1.8	2.8	2.5	14 0	8.7

Note.—Subscript numbers indicate number of tests when different from that shown in column "Number of Tests."
See "Variability of Timber" page 14.

TABLE 2

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS
AIR-SEASONED MATERIAL
Taken from U. S. Forest Service Bulletin 108.

Species	Cross Section under Test	No. of Tests	Rings per Inch	Moisture Content	Weight per Cu. Ft. Oven-dry	Fiber Stress at Elastic Limit per Sq. In.	Modulus of Rupture per Sq. In.	Modulus of Elasticity per Sq. In.	Relative Strength based on Modulus of Rupture. Douglas Fir=100 per cent	Relative Stiffness based on Modulus of Elasticity. Douglas Fir=100 per cent	Knots in Stringers Tested					
											Vol. I		Vol. II		Vol. III	
											Less than 1½ In.	1½ In. and over	Less than 1½ In.	1½ In. and over	Less than 1½ In.	1½ In. and over
	Inches			Per Cent	Lbs.	Lbs.	Lbs.	1000 lbs.	Per Cent	Per Cent						
Douglas Fir	8x16	64	15.2	20.9	27.8	4931	7142	1641	100.0	100.0	0.5	0.1	1.2	0.2	12.1	0.9
Long-leaf Pine	8x16 6x16 6x10	7	12.7	21.6	38.6	3793 (6)	5957	1720	83.6	104.8	None	None	None	None	None	None
Short-leaf Pine	8x16 8x14 8x12	9	12.3	16.3	32.1	5186	7033	1782	98.5	108.6	None	None	0.2	0.5	2.8	1.6
Western Hemlock	8x16	31	17.5	17.7	28.4	4828 (30)	7109	1805 (30)	99.6	110.0	0.3	0.1	1.6	0.5	8.0	0.7
Loblolly Pine	8x16 6x16 6x10 8x 8	21	6.5	21.1	33.1	3706	6259	1521	87.7	92.7	0.4	1.1	0.4	0.8	2.8	3.4
Western Larch	8x16 8x12	36	23.0	18.2	29.8	3904	6534	1561	91.5	95.1	1.8	0.3	3.2	0.6	19.4	1.6
Redwood	8x16 6x12 7x 9	12	18.1	17.3	22.2	3747 (7)	4573	946 (7)	64.1	57.6	0.1	None	0.8	0.3	3.0	1.3
Tamarack	6x12	4	16.6	23.4	30.8	3643	5865	1385	82.3	84.4	1.8	None	0.8	None	18.0	0.5
Norway Pine	6x12	4	7.8	17.0	26.4	2928	5255	1103	73.7	67.2	3.5	1.5	2.3	0.5	17.5	9.3

Note.—Subscript numbers indicate number of tests when different from that shown in column "Number of Tests."

See **"Variability of Timber" page 14.**

of knots, therefore approximately 30 per cent of the Douglas fir stringers, car sills and joists were chosen with knots in the tension face which materially affected the strength. Such timbers should not be included in establishing strength values for any species. No stringers were used in tables 1 and 2 in which the cross section was less than 60 square inches.

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS
(Grade I, Tentative Grading Rules, U. S. Forest Service)
GREEN MATERIAL
Results taken from U. S. Forest Service Bulletin 108, Page 65, Table 8.

TABLE 3

Species	No. of Tests	Fiber Stress at Elastic Limit per Sq. In.	Modulus of Rupture per Sq. In.	Modulus of Elasticity per Sq. In.	Relative Strength based on Modulus of Rupture. Douglas Fir =100 per cent	Relative Stiffness based on Modulus of Elasticity. Douglas Fir =100 per cent
		Lbs.	Lbs.	1000 lbs.	Per Cent	Per Cent
Douglas Fir......	81	4402	6919	1643	100.0	100.0
Longleaf Pine....	17	3734	6140	1463	88.7	89.0
Loblolly Pine....	45	3513	5898	1535	85.3	93.4
Shortleaf Pine....	35	3318	5849	1525	84.5	92.8
Western Hemlock	26	3689	5615	1481	81.1	90.2
Western Larch...	45	3662	5479	1365	79.2	83.1
Tamarack.......	9	3151	5469	1276	79.0	77.7
Redwood........	21	4031	4932	1097	71.3	66.8
Norway Pine.....	17	3082	4821	1373	69.6	83.6

Note.—See "Variability of Timber" page 14.

Table 3 probably shows the best available data published in any Government bulletin for comparing the strength of different species of structural timber. The data in this table are taken from U. S. Forest Service Bulletin No. 108, page 65. This table shows results of tests on a large number of stringers of different species graded by the tentative grading rule of the U. S. Forest Service. All these timbers were of practically the same grade. The results show Douglas fir to be the strongest wood with a modulus of rupture of 6,919 pounds per square inch. This value is based on 81 tests of full size bridge stringers. The modulus of elasticity for the same set of stringers is 1,643,000 pounds per square inch.

Horizontal Shear. There seems to be an impression among those unfamiliar with Douglas fir that this wood is not capable of developing a high unit stress in horizontal shear. The erroneous impression has come largely from comparing the shearing stress developed in Douglas fir beams tested on long spans and in many

cases under center loading, with similar shearing stresses developed in timbers of other species tested on shorter spans under third point loading. Since the horizontal shear developed depends on the maximum load, it is very clear that a higher shear will be developed in beams tested under third point or uniform loading than in those tested under center loading. Due to this fact the horizontal shearing stress developed in Douglas fir stringers tested under center loading should not be compared to that developed in stringers of other species tested under third point loading.

Tables 4 and 5 show the horizontal shear developed in 8″x16″x16′ Douglas fir bridge stringers tested under one-third point loading on a 15-foot span. These results were obtained from the Seattle Timber Testing Laboratory of the U. S. Forest Service and they do not appear in any other publication in the form here shown. The results are very significant and show that Douglas fir is capable of resisting high horizontal shearing stresses.

HORIZONTAL SHEAR DEVELOPED IN 53—8″x16″x16′ DOUGLAS FIR BEAMS—GREEN MATERIAL

Tested on a 15-foot Span Under 1/3 Point Loading

Data furnished by U. S. Forest Service from results of tests made at the Seattle Timber Testing Laboratory.

TABLE 4

Grade	No. of Tests	Maximum Horizontal Shear Developed per Sq. In.	Number Failing in Horizontal Shear	Shear Developed in Stringers Failing in Horizontal Shear per Sq. In.		
				Average	Maximum	Minimum
		Lbs.		Lbs.	Lbs.	Lbs.
Clear and Select..........	25	405	3	471	474	468
Merchantable............	15	404	8	425	476	391
Common................	13	330	1	371	371	371

Table 4 shows results for green stringers and table 5 gives similar results for air seasoned material. Of 53 green stringers tested 25 were of clear and select grades, 15 merchantable and 13 common. The grading rule used in grading these timbers was the export rule of the West Coast Lumber Manufacturers' Association. Of the 25 stringers of clear and select grades, 3 failed in horizontal shear at an average stress of 471 pounds/sq. inch. The maximum was 474 and the minimum 468 pounds/sq. inch. Eight of the 15 merchantable sticks failed by horizontal

shear at an average stress of 425 pounds/sq. inch. The maximum was 476 and the minimum 391 pounds/sq. inch.

HORIZONTAL SHEAR DEVELOPED IN 19—8"x16"x16' DOUGLAS FIR BEAMS—AIR-SEASONED MATERIAL

Tested on a 15-foot Span Under 1/3 Point Loading

Data furnished by U. S. Forest Service from results of tests made at the Seattle Timber Testing Laboratory.

TABLE 5

Grade	No. of Tests	Maximum Horizontal Shear Developed per Sq. In.	Number Failing in Horizontal Shear	Shear Developed in Stringers Failing in Horizontal Shear per Sq. In.		
				Average	Maximum	Minimum
		Lbs.		Lbs.	Lbs.	Lbs.
Clear	7	444	7	444	615	364
Merchantable	6	386	3	375	488	256
Common	6	385	5	384	427	351

Table 5 shows similar results for 19 air seasoned stringers.

Of 16 full sized green bridge stringers recently tested at Portland by the Bureau of Standards (see table 16, page 43) 9 failed by horizontal shear developing an average stress of 426 pounds/sq. inch with a maximum of 503, and a minimum of 381 pounds/sq. inch.

CRUSHING STRENGTH OF LARGE SIZES

Tables 6 to 8 show the maximum compressive strength of short columns of Douglas fir, western hemlock, and western larch. In these tables the material has been grouped into four classes, namely, clear specimens, specimens containing knots ½" in diameter or less, specimens containing knots ½" to 1½" in diameter, and specimens containing knots larger than 1½" in diameter. Results are shown for both green and air seasoned material except in the case of Douglas fir.

In the mining districts of the United States both round and square timbers are used. In an effort to show the relative value of timbers used for this purpose, table 9 has been prepared. This table shows the maximum crushing strength in pounds per sq. inch for mine timbers of a number of western species. The strength of a number of the Rocky Mountain species which are used extensively in mine work is also given. This comparison shows the great superiority of the Coast woods over those grown in the high altitudes.

AVERAGE STRENGTH VALUES FOR DOUGLAS FIR IN COMPRESSION PARALLEL TO GRAIN

6"x6"x18" POSTS

Results taken from U. S. Forest Service Bulletin 88, Page 33, Table 6.

TABLE 6

GREEN MATERIAL

Material	No. of Tests	Rings per Inch	Moisture Content	Weight per Cubic Foot		Compressive Strength at Elastic Limit per Sq. In.	Crushing Strength at Maximum Load per Sq. In.	Modulus of Elasticity per Sq. In.
				As Tested	Oven-dry			
			Per Cent	Lbs.	Lbs.	Lbs.	Lbs.	1000 lbs.
Clear............	130	11.8	30.4	38.1	29.2	3099	3918	1321
Pin knots (½" or less in diameter)	62	10.4	31.6	37.7	28.6	2931	3698	1401
Standard knots (½" to 1½" in diameter)...........	227	9.0	30.9	37.8	28.9	2708	3386	1187
Large knots (over 1½" in diameter)	97	9.4	29.9	38.0	29.3	2406	3062	940

AVERAGE STRENGTH VALUES FOR WESTERN HEMLOCK IN COMPRESSION PARALLEL TO GRAIN

6"x6"x24" POSTS

Results taken from U. S. Forest Service Bulletin 115, Page 21, Tables 5 and 6.

TABLE 7

GREEN MATERIAL

Material	No. of Tests	Rings per Inch	Moisture Content	Weight per Cubic Foot		Compressive Strength at Elastic Limit per Sq. In.	Crushing Strength at Maximum Load per Sq. In.	Modulus of Elasticity per Sq. In.
				As Tested	Oven-dry			
			Per Cent	Lbs.	Lbs.	Lbs.	Lbs.	1000 lbs.
Clear	46	15.7	48.5	41.2	27.7	3018	3507	1676
Pin knots (½" or less in diameter)	12	12.5	48.4	38.1	25.6	2880	3396	1670
Standard knots (½" to 1½" in diameter)	11	15.7	42.0	36.6	25.8	2838	3197	1624
Large knots (over 1½" in diameter)	13	14.6	42.0	37.9	26.8	2590	2901	1364
AIR-SEASONED MATERIAL								
Clear	64	18.6	18.4	32.9	27.8	5176	5952	2109
Pin knots (½" or less in diameter)	8	18.2	18.6	33.3	28.1	4523	6051	1756
Standard knots (½" to 1½" in diameter)	25	18.1	18.8	34.0	28.6	4556	5516	2217
Large knots (over 1½" in diameter)	5	14.7	19.3	35.9	30.1	4248	5150	2215

AVERAGE STRENGTH VALUES FOR WESTERN LARCH IN COMPRESSION PARALLEL TO GRAIN

6"x6"x24" POSTS

Results taken from U. S. Forest Service Bulletin 122, Page 20, Tables 5 and 6

TABLE 8

GREEN MATERIAL

Material	No. of Tests	Rings per Inch	Moisture Content	Weight per Cubic Foot		Compressive Strength at Elastic Limit per Sq. In.	Crushing Strength at Maximum Load per Sq. In.	Modulus of Elasticity per Sq. In.
				As Tested	Oven-dry			
			Per Cent	Lbs.	Lbs.	Lbs.	Lbs.	1000 lbs.
Clear............	51	25.4	52.3	44.8	29.3	2635	3630	1528
Pin knots (½" or less in diameter).....	20	21.7	48.1	42.9	28.9	2955	3772	1820
Standard knots (½" to 1½" in diameter)...........	28	24.2	44.5	39.2	27.0	2577	3226	1521
Large knots (over 1½" in diameter)	8	23.8	46.2	40.5	27.8	2569	3069	1442
AIR-SEASONED MATERIAL								
Clear............	67	26.5	15.0	36.1	31.3	3801	6253	1769
Pin knots (½" or less in diameter).....	69	24.3	15.8	35.5	30.7	3165	5994	2025
Standard knots (½" to 1½" in diameter)...........	49	22.3	15.6	33.1	28.6	2553	4921	1500
Large knots (over 1½" in diameter)	8	22.9	15.5	31.8	27.5	....	4520	....

STRENGTH OF CLEAR WOOD

Table 10 shows results of tests on small, clear, green specimens. The values given are averages and give a fair idea of the strength of the various species in this form of material.

The following diagram is taken from U. S. Forest Service Bulletin 88 and may be used in estimating the strength of small, clear specimens which have seasoned to a point where strength begins to increase. For example, U. S. Forest Service Bulletin 108, page 71, shows the strength of small, clear Douglas fir beams 2"x2" in cross section containing 19 per cent moisture to be 10,378 pounds/sq. inch. If similar 2"x2" beams of Douglas fir containing 16 per cent moisture had been tested the modulus of rupture should have been $10{,}378 \times \frac{12{,}400}{9{,}300} = 13{,}840$ pounds/sq. inch.

Any other corrections in strength values may be made in a similar manner.

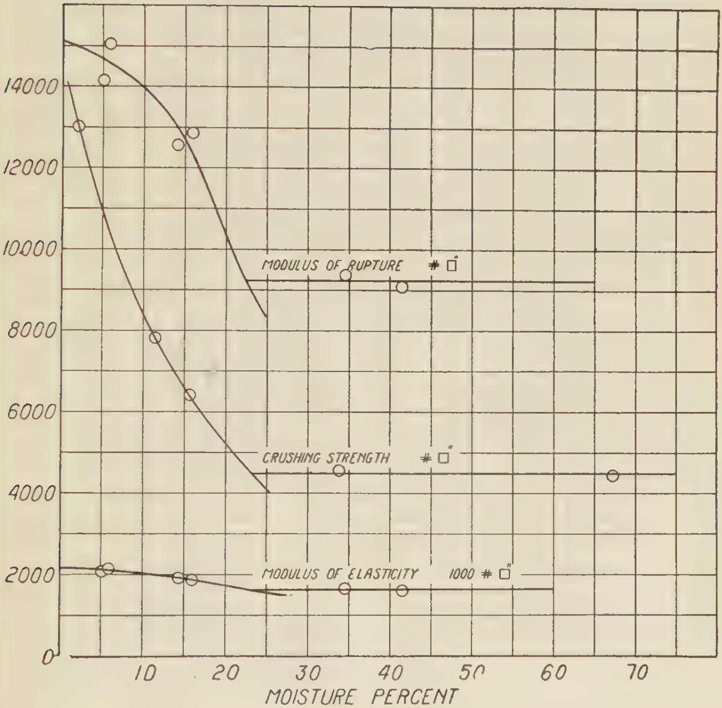


Diagram 1. Relation between moisture content and strength values for small clear specimens of Douglas Fir.

AVERAGE MAXIMUM CRUSHING STRENGTH FOR MINE TIMBERS* IN COMPRESSION PARALLEL TO GRAIN—GREEN MATERIAL

Results taken from U. S. Forest Service Bulletin 88, Page 33, Table 6, and U. S. Dept. of Agriculture, Bulletin 77, Page 5. Table 2.

TABLE 9

Species	Grade	No. of Tests	Locality of Growth	Form of Material	Maximum Crushing Strength per Sq. In.	Relative Strength. Pacific Coast Douglas Fir=100 per cent
					Lbs.	Per Cent
Douglas Fir	All Grades	516	Washington and Oregon	Square Timber	3500	100.0
Douglas Fir	All Grades	10	Rocky Mountain Region	Round Timber	2580	73.7
Western Yellow Pine	All Grades	10	Rocky Mountain Region	Round Timber	1940	55.4
Alpine Fir	All Grades	9	Rocky Mountain Region	Round Timber	1920	54.8
Lodgepole Pine	All Grades	10	Rocky Mountain Region	Round Timber	1865	53.3
Englemann Spruce	All Grades	11	Rocky Mountain Region	Round Timber	1750	50.0
Bristle-cone Pine	All Grades	10	Rocky Mountain Region	Round Timber	1657	47.3

*Square timbers—6″x6″x18″ posts. Round timbers—6′ length, 5″ top diameter.

Note.—See "Variability of Timber" page 14.

TABLE 10

AVERAGE STRENGTH VALUES FOR SMALL CLEAR PIECES
GREEN MATERIAL

Results taken from U. S. Forest Service Publications—Bulletins 88 and 108, Circular 213.

Species	No. of Tests	Moisture Content	Rings per Inch	Weight per Cu. Ft. Ovendry	Static Bending			Compression ‖ to Grain	Compression ⊥ to Grain	Shear ‖ to Grain	Strength per Pound of Ovendry Weight. Based on Modulus of Rupture per Sq. In.
					Fiber Stress at Elastic Limit per Sq. In.	Modulus of Rupture per Sq. In.	Modulus of Elasticity per Sq. In.	Crushing Strength at Maximum Load per Sq. In.	Compressive Strength at Elastic Limit per Sq. In.	Shearing Strength per Sq. In.	
		Per Cent		Lbs.	Lbs.	Lbs.	1000 lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Douglas Fir	423	31.0	11.0	29	5463	8350	1596	4100	570	765	290
Longleaf Pine	250*	63.0	16.5	33	5090	8630	1662	4280	491	1007	262
Shortleaf Pine	254	51.7	13.6	30	4350	7710	1395	3570	400	704	257
Western Hemlock	52	51.8	12.1	27	4406	7294	1428	3392	....	630	270
Loblolly Pine	44	70.9	5.4	31	4100	7870	1440	3340	....	630	254
Western Larch	189	46.2	26.2	28	4274	7251	1310	3696	....	700	259
Redwood	157	75.5	19.1	22	4750	6980	1061	3980	569	742	317
Tamarack	82	38.8	14.0	30	3875	6820	1141	3190	....	668	227
Norway Pine	133	32.3	11.4	25	2808	5173	960	2504	....	589	207

* Approximation.

Note.—See "Variability of Timber" page 14.

GRADING RULES FOR STRUCTURAL TIMBERS

The dry weight of small clear specimens, particularly for wood containing little or no resinous substance, is a definite indication as to the strength of the wood fiber. This fact is shown for Douglas fir in U. S. Forest Service Bulletin 108, figure 15, page 39; with an increase in dry weight of from 19 to 36 pounds per cubic foot, there is an accompanying increase in strength (modulus of rupture) of from 5,500 to 10,500 pounds per square inch. These figures indicate increases of 47.2 and 47.7 per cent respectively for weight and strength based on the maximum values. The question now arises, does this same law hold for timbers of standard structural sizes? In order to get some data on this point, diagrams 2 and 3 have been prepared. These diagrams are obtained from the results of tests of Douglas fir bridge stringers in which defects did not cause first failure. The strength values are taken from U. S. Forest Service Bulletin 108. In each of these diagrams the timbers have been arranged in the order of their strength (modulus of rupture), and the corresponding dry weights in pounds per cubic foot plotted in each case. Diagram 2 shows results of tests of green Douglas fir timbers (8"x16"x16'), and diagram 3 shows similar results for air seasoned Douglas fir stringers. Diagram 2, "Green Timbers," shows that with an average increase in strength of from 4,800 to 8,250 pounds per square inch, there is an average increase in dry weight of from 26.7 to 31.8 pounds per cubic foot. These figures indicate that for an increase in strength of 41.9 per cent there is an increase in weight of 16.1 per cent. Diagram 3, "Air Seasoned Timbers," shows that with an average increase in strength of from 5,350 to 8,760 pounds per square inch, there is an average increase in dry weight of from 24.2 to 30.7 pounds per cubic foot.

These figures indicate that for an increase in strength of 39.0 per cent, there is an increase in weight of 21.2 per cent. In both diagrams 2 and 3 the dry weights often vary almost to extremes when no appreciable variation is found in the strength. In diagram 3 the last portion of the curve shows a marked increase in weight, which is accompanied by a very decided drop in strength. Diagram 2 shows no drop in weight over the last quarter of the curve where the drop in strength is very material. In other words, the relation found between dry weight and strength is erratic, and the dry weight cannot be depended upon

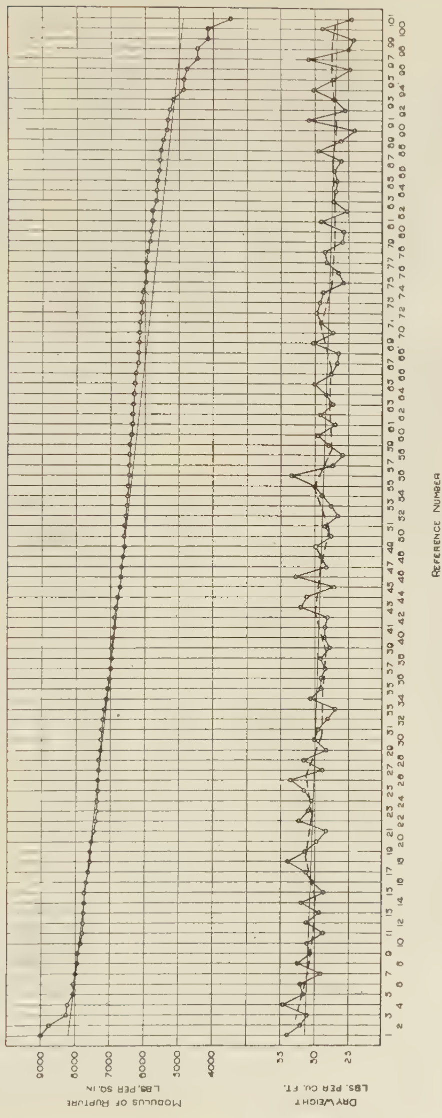


Diagram 2. Relation between Modulus of Rupture and Dry Weight. Green Douglas fir bridge stringers 8″x16″ in cross-section tested on a 15′ span.

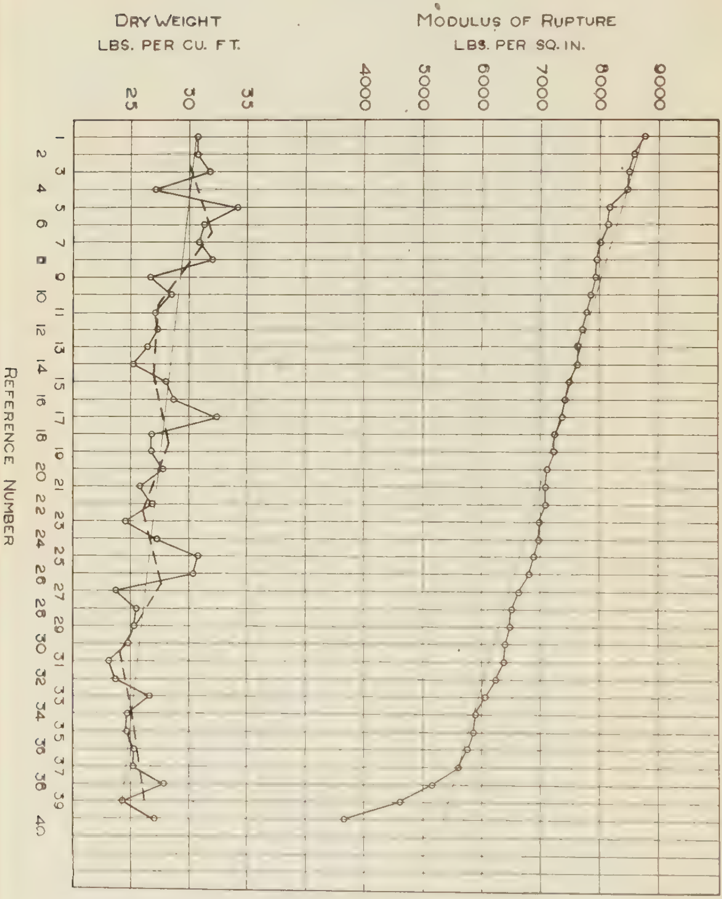


Diagram 3. Relation between Modulus of Rupture and Dry Weight. Air-seasoned Douglas fir bridge stringers 8"x16" in cross-section tested on 15' span.

to forecast the strength of structural timbers containing defects to any great degree of certainty.

Exhaustive tests show that good quality timbers exhibit high strength values both before and after seasoning. Some species show a greater tendency to check in seasoning than others, and consequently are apt to show less gain in strength and sometimes a loss due to seasoning. Douglas fir and western hemlock exhibit an average tendency to check, but tests show that timbers of these species maintain their original green strength after seasoning plus some additional strength, depending upon the character of the original material and the amount of checking which occurs due to seasoning.

For reasons, as shown above, it is not practicable to go to the refinement of determining the true density of individual timbers. It is sufficient to examine a timber and see that it has reasonable density based on the amount of summerwood and that it is free from injurious defects.

The standard grade used on the Pacific Coast at the present time to secure high grade structural timbers is "Selected Common." This grade covers timbers selected from the grade known as No. 1 Common as shown below.

"No. 1 COMMON"

"This grade shall consist of lengths 8 feet and over (except shorter lengths be ordered) of a quality suitable for ordinary constructional purposes. Will allow small amount of wane, large sound knots, large pitch pockets, colored sap one-third the width and one-half the thickness, slight variation in sawing and slight streak of solid heart stain."

"Defects to be considered in connection with the size of the piece."

"Discoloration through exposure to the elements or season checks not exceeding in length one-half the width of the piece shall not be deemed a defect excluding lumber from this grade, if otherwise conforming to the grade of No. 1 Common."

"SELECTED COMMON"

"This is a grade selected from the grade of No. 1 Common, and shall consist of lumber free from defects that materially impair the strength of the piece, well manufactured and suitable

for high class constructional and structural purposes or the purpose for which it is intended, including bridge timbers, floor joists, ship timbers, factories and warehouses, designed to carry heavy loads, etc."

The "Selected Common" grade will secure good material for general constructional purposes. There is a demand, however, for a rule which will make a still closer separation of timbers, eliminating all pieces not possessing high strength values.

In formulating the following proposed grading rules for "Selected Structural Douglas Fir Timbers" an effort has been made to form a rule which is simple, practicable and fair to both producer and consumer. Above all it has been the aim by means of this rule to obtain a grade of timber which is suitable for the highest class of construction work and which will admit only timbers of high strength values. There is a demand for such a rule and it will be possible with this rule to use a higher safe fiber stress than that in use at the present time for timbers of the ordinary grades. This rule does not in any way take the place of other rules of the West Coast Lumbermen's Association, but it is intended for use in securing particularly strong timbers. Careful consideration in forming the rule has been given to defects of the common type and to the influence of quality of the wood fiber. The position of knots in stringers bears a very close relation to the strength of the piece, therefore special attention has been given to this subject. Figure 3 shows a beam divided into three volumes. Volumes 1 and 2 are portions in which maximum fiber stresses are developed and volume 3 is the portion of low tensile and compressive stresses.

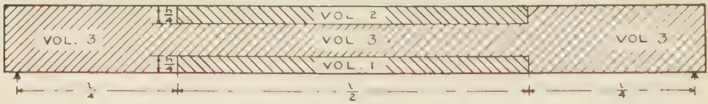


Fig. 3. Division of stringer into volumes for considering position of knots.

Stringers of the highest grade must also be composed of dense strong fiber and free from all injurious defects. With these points in mind, the following specification has been prepared which allows fairly large knots in volume 3 but restricts to 1½" the size of the knots in volumes 1 and 2.

SELECTED STRUCTURAL DOUGLAS FIR
SPECIFICATION FOR BRIDGE AND TRESTLE TIMBERS
PROPOSED RULE

1. DEFINITIONS. The following definitions are used in connection with this grading rule:

(a) *Annual Ring.* Each annual ring is composed of two distinct types of wood structure i. e., the porous, light colored and light weight springwood formed during the first part of the growing season and the hard, dense and darker colored summerwood formed during the latter part of the growing season.

(b) *Summerwood.* Summerwood is the hard, dense portion of the annual ring. It is darker in color than the more porous springwood.

(c) *Sound and Tight Knot.* A sound and tight knot is one which is solid across its face and which is as hard as the wood surrounding it; and is so fixed by growth or position that it will retain its place in the piece.

(d) *Encased Knot.* An encased knot is one whose growth rings are not intergrown and homogeneous with the growth rings of the piece in which it occurs. The encasement may be partial or complete; if intergrown partially or so fixed by growth or position that it will retain its place in the piece, it shall be considered a sound and tight knot.

(e) *Loose Knot.* A loose knot is one not firmly held in place by growth or position.

(f) *Rotten Knot.* A rotten knot is one not as hard as the wood surrounding it.

(g) *Measurement of Knots.*

In Beams the diameter of a knot on the narrow or horizontal face shall be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

In Columns the diameter of a knot on any face shall be taken as its projection on a line perpendicular to the edge of the timber.

(h) *Diagonal Grain.* (Including cross and spiral grain.) Diagonal grain is grain not parallel with all the edges of the piece.

(i) *Dense Douglas Fir.* Shall show on either one end or the other an average of at least 6 annual rings per inch or 18 rings in 3 inches and at least 33 1/3 per cent summerwood, as measured

over the third, fourth and fifth inches on a radial line from the pith, for girders not exceeding 20″ in height, and for columns 16″ square or less. For larger timbers the inspection shall be made over the central 3 inches on the longest radial line from the pith to the corner of the piece. Wide ringed material excluded by the above will be accepted provided the amount of summerwood as above measured shall be at least 50 per cent.

In case where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 inches on an approximate radial line beginning at the edge nearest the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller as to what is a representative radial line the average summerwood and number of rings shall be the average of the two radial lines chosen.

2. General Requirements.

(a) Shall contain only *Dense Douglas Fir* timbers as defined in paragraph (i).

(b) Shall consist of lumber, well manufactured, square edge and sawed standard size; solid and free from defects such as ring shakes and injurious diagonal grain; loose or rotten knots; knots in groups; decay; pitch pockets over 6 inches long or 3/8 inch wide or other defects that will materially impair its strength.

(c) Occasional variation in sawing not to exceed 1/4 inch scant at time of manufacture allowed.

(d) When timbers 4″x4″ and larger are ordered sized, they will be 1/2 inch less than rough size, either S1S1E or S4S, unless otherwise specified.

Stringers, Girders and Deep Joists. Shall show not more than 15 per cent of sap on each of the four sides, measured across the sides anywhere in the length of the piece. Shall not have in volumes 1 and 2 knots greater in diameter than 1/4 the width of the face in which they occur with a maximum of 1 1/2 inches in diameter. Shall not have in volume 3 knots larger than 1/3 the width of the face in which they occur with a maximum of 3 inches in diameter. Knots within the center half of the span shall not exceed in the aggregate the width of the face in which they occur. Shall not permit diagonal grain in volumes 1 or 2 with a slope greater than one in twenty. When stringers are of two span length they shall be considered as two separate pieces

and the above restrictions applied to each half. The inspector shall place his stamp on the edge of the stringer to be placed up in service.

Caps and Sills. Selected structural Douglas fir shall show not more than 15 per cent of sap on each of the four sides, measured across the sides anywhere in the length of the piece, and shall be free from knots larger than ¼ the width of the face in which they occur with a maximum of 3 inches in diameter. Knots shall not be in groups.

Posts. Selected structural Douglas fir shall show not more than 15 per cent of sap, measured across the face anywhere in the length of the piece, and shall be free from knots larger than ¼ the width of the face in which they occur with a maximum of 3 inches in diameter. Knots shall not be in groups.

Longitudinal Struts or Girts. Selected structural Douglas fir shall show no sap on one face; the other face and two sides shall show not more than 15 per cent of sap, measured across the face or side anywhere in the piece, and shall be free from knots over 2 inches in diameter.

Longitudinal X-Braces, Sash Braces and Sway Braces. Selected structural Douglas fir shall show not more than 15 per cent of sap on two faces and four square edges, and shall be free from knots over 2 inches in diameter.

Branding. The inspector shall brand each timber which conforms to the above requirements "Selected Structural Douglas Fir."

RECOMMENDED WORKING UNIT STRESSES

The following table shows the working stresses recommended in the latest building codes of the cities of Seattle, Wash., and Portland, Oregon. The City of Seattle Building Code was issued in 1914, while that of the City of Portland has more recently been revised.

WORKING UNIT STRESSES RECOMMENDED IN SEATTLE AND PORTLAND BUILDING CODES

TABLE 11

Species	City	Extreme Fiber Stress and Tension with Grain	Compression Parallel to Grain	Compression across Grain	Shear: Horizontal in Beams	Shear: Parallel to Grain Direct	Tension across Grain
Douglas Fir..	Seattle.....	1600	1600	400	150	200	....
	Portland...	1800	1600	400	175	240	100
Western Hemlock..	Seattle.....	1400	1400	350	130	180	....
	Portland...	1500	1500	290	120	180	75

After making a careful study of the structural properties of Douglas fir and western hemlock, the following values are recommended by the West Coast Lumbermen's Association for selected structural Douglas fir timbers:

WORKING UNIT STRESSES RECOMMENDED BY WEST COAST LUMBERMEN'S ASSOCIATION

TABLE 12

Species	Class of Construction	Extreme Fiber Stress and Tension with Grain	Compression Parallel to Grain	Compression across Grain	Shear: Horizontal in Beams	Shear: Parallel to Grain Direct	Tension across Grain
Douglas Fir..	Protected Structures.	1800	1600	400	175	240	100
	Highway Structures	1500	1330	330	150	200	85
	Railway Structures	1200	1070	270	120	160	65
Western Hemlock..	Protected Structures	1500	1500	310	120	180	75
	Highway Structures	1250	1250	260	100	150	65
	Railway Structures	1000	1000	210	80	120	50

KILN DRYING DOUGLAS FIR

Kiln drying is one of the important phases of lumber manufacture. Of late years a great many improvements have been made in the construction of kilns, and in the methods of piling, heating and ventilating. Some woods are much more difficult to kiln dry satisfactorily than others, but the general principles herein mentioned apply to all woods, and particularly to Pacific Coast species.

1. The heat should be carefully regulated. Extremely high temperatures cause the wood to become to brittle.

2. The piling should be such as to enable the heat to enter the wood uniformly, and the use of wide stickers should be avoided. Vertical piling has done a great deal toward the elimination of checking and warping.

3. Draughts of outside air and too much ventilation cause the lumber to check and warp. Steam baths before drying greatly aid in preventing checking, warping and case hardening.

Pacific Coast woods present no serious problems in kiln drying, and with the perfected methods now in use a thoroughly satisfactory product is obtained.

All finish lumber should be properly kiln dried before being placed in a building. Correct methods of kiln drying prevent the resin from oozing through the varnish and also largely eliminate shrinking and swelling, and aid in securing high class finish.

Dimension lumber is now dried for uses where dry material is desirable. No serious difficulties are experienced in drying dimension stock up to three inches in thickness.

CREOSOTING DOUGLAS FIR

The creosoting of Douglas fir has been practiced on the Pacific Coast for more than 25 years. The creosoting of such forms as lumber, piling and paving blocks has proved an entire success. Douglas fir is a hard wood to treat, however, and it has required a great deal of study and experimenting to produce thoroughly satisfactory results. There are two general classes of creosoted material, as follows:

1. Wood which must retain its full strength after treatment.

2. Wood in which the strength is not so important, the real problem being that of protection against wood-destroying agents.

The second class of material mentioned has caused no trouble. The difficulty has been with the first class.

Both the steaming and boiling processes of treatment have been employed in creosoting Douglas fir. The steaming process will produce a good penetration, probably slightly better than the boiling, but it also appears to weaken the timber slightly more than the boiling process. In such forms as bridge stringers and ties, treatments sufficiently severe to obtain satisfactory penetrations have caused a material loss in strength. The problem, therefore, which has confronted the industry on the Pacific Coast has been that of developing a process of creosoting these forms which would secure a thorough penetration and at the same time would not cause a material loss in strength.

From experiments which have been made it has been shown that high temperatures and high pressures in these treatments are largely responsible for the loss in strength of the wood, which under such treatments amounted to as much as 33 to 35 per cent in bridge stringers. Even greater losses than these have occurred in the treatment by the above processes of Douglas fir ties. These treatments in the past have been applied about as follows:

BOILING PROCESS

The timbers were placed in the retort in a green condition, and boiled in creosote oil under atmospheric pressure for 22 to 24 hours at a temperature ranging from 230° to 260° Fahr.. This boiling period was used to season the timber and prepare it for receiving the oil. After the boiling period was completed, pressure was applied beginning with zero and rising as high as 145 to 185 pounds per square inch. The pressure was continued over a period of 4 to 6 hours, at a temperature of approximately 210° to 230° Fahr.. By this method 10 to 14 pounds of oil per cubic foot were injected into the wood.

STEAMING PROCESS

The timbers were placed in the retort in a thoroughly green condition and steamed at 90 pounds per square inch for 4 to 7 hours at a temperature of approximately 325° to 335° Fahr.. A vacuum of approximately 20 inches was then applied for 18 to 20 hours at a temperature of about 220° Fahr.. At the end of the vacuum period creosote oil was introduced and pressure applied, rising from zero up to 160 pounds per square inch. This pressing period was continued for 2 to 4 hours at a temperature of approximately 208° Fahr.. Ten to 14 pounds of oil per cubic foot were usually injected by this process.

It will be noted that in both the above processes high temperatures were applied. The temperature used in the boiling process was lower than that used in the steaming, but was applied for a longer period. The steaming process employed a higher temperature for a shorter period of time.

In recent experiments both temperature and pressure have been reduced and the vacuum made to take a more important part in the process. The most successful treatment yet devised for treating bridge stringers and similar forms without loss in strength is that of "boiling under a vacuum." When green timbers are creosoted by this method the treatment requires approximately 26 hours, and is in general, as follows:

BOILING UNDER A VACUUM PROCESS

The timbers are placed in the retort and creosote oil introduced at a temperature of 160° to 180° Fahr.. Heat is applied and the temperature of the oil gradually raised to 190° Fahr. and held at that temperature for 5 to 6 hours, a sufficient length of time to warm the timbers through. When the timbers are thoroughly warmed a vacuum of 24 to 27 inches is drawn on the oil, still holding a temperature of 190° Fahr.. This vacuum is

drawn through an overhead pipe extending from the top of the retort for 36 feet vertically into the air and returning to the condenser. The purpose of this pipe is to prevent the creosote oil from boiling over into the condenser. This vacuum is started at 16 to 18 inches, and as the timber seasons is gradually raised to 24 to 27 inches. The full period of vacuum is 12 to 16 hours. It is continued until the rate of seasoning of the timber is 1/10 pound of water per cubic foot of wood perhour. After this finished rate of seasoning is reached the vacuum is broken and pressure on the oil started, which rises as high as 120 to 135 pounds per square inch, and continues over a period of 4 to 6 hours. The temperature of the oil during the pressure period drops from 190° to 180° Fahr.. By this process 10 to 14 pounds of oil per cubic foot may be pressed into the wood.

This method of treatment is a slight modification of the Boulton process and at the low temperatures used seasons the wood even better than the old boiling process, which employed so much higher temperatures. Timbers treated by the method of boiling under a vacuum apparently receive the creosote oil more readily than timbers treated under the old boiling process.

Bridge Stringers. In order to carry the test still further and to determine the effect of this treatment (Boiling Under a Vacuum) on the strength of the wood, two shipments of full-sized bridge stringers were selected, and treated in four different charges. These stringers were of three sizes, 7″x14″x28′, 7″x16″x30′ and 10″x14″x28′. After treatment the stringers were shipped to Portland, Oregon and tested by the Bureau of Standards. The results of the tests are shown in the following report:

City of Portland
Department of Public Works
Bureau of Standards

Report of bending tests of creosoted and natural stringers. Tested for O. P. M. Goss, consulting engineer for the Association of Creosoting Companies of the Pacific Coast.

Purpose. The purpose of these tests was to determine the effect of creosoting by the "Boiling Under a Vacuum" process on the strength of Douglas fir bridge stringers in transverse bending.

Material. The material consisted of merchantable grade Douglas fir stringers of the following sizes:

9— 7″x14″x28′
3— 7″x16″x30′
5—10″x14″x28′

They were selected so that the two halves of the stringers were of as nearly equal quality as it was possible to obtain.

They were then cut in the middle and one-half treated by the above process. Both natural and treated halves were brought to Portland, and tested by the Bureau. The untreated timbers were tested in a thoroughly green condition.

One of the 7"x16"x15' natural stringers and the corresponding treated one gave unusually low results when tested. Both the natural and the treated stringers were cut up into sections and thoroughly examined after test. It was discovered that a heart shake was present in both pieces, the creosote showing plainly along this shake in the treated timber. This stringer failed in shear along this shake at a very low load, after which this load increased considerably before final rupture of the beam. The result of the tests on these defective stringers are therefore not included in this report, failure being due entirely to this defect present before treatment.

METHOD OF TEST. The method of testing was identical with that used in previous tests made on structural timbers by the U. S. Forest Service and described in Forest Service Circular No. 38 (Revised). The stringers were tested on a 150,000-pound Universal Riehle machine under third point loading, the load being applied at two points, each one-third the length of the span from the end supports. The 7"x14"x14' and the 10"x14"x14' pieces were tested on a 13-foot span and the 7"x16"15' pieces on a span of 14 feet. The load was applied continuously, the head of the machine descending at the rate of 0.139 inches per minute, and the load increments and corresponding deflections recorded. The manner of failure at maximum load was noted in each case. The strength values were computed from U. S. Forest Service formulae and are therefore comparable with previous tests on structural timber.

After the tests were completed, photographs were made of identification sections taken from each of the natural and treated stringers, except one set which was lost through a misunderstanding. These sections show the quality of the growth in the timbers and the amount of penetration secured in the treated pieces. The tables* and diagrams* complete this report. Table 13 contains results of the tests on the 7"x14"x14' stringers and shows the modulus of rupture or breaking strength of the treated material to be 101.2 per cent that of the natural. Table 14, giving strength values for 7"x16"x15' stringers shows a modulus of rupture for the treated of 101.8 per cent of the corresponding natural. Table 15 shows results of the 10"x14"x14' beams. The untreated material had a slight advantage in breaking strength, the treated being 95 per cent as strong as the natural. Table 16 is a summary of the preceding tables and shows the average modulus of rupture for the treated stringers of all sizes to be 99.2 per cent that of the natural pieces. The following diagrams show the results of the individual tests and a record of the treatment used. The graphs for the natural and corresponding treated stringers are given side by side.

*Refers to tables 13 to 16 and diagrams 6 to 9.

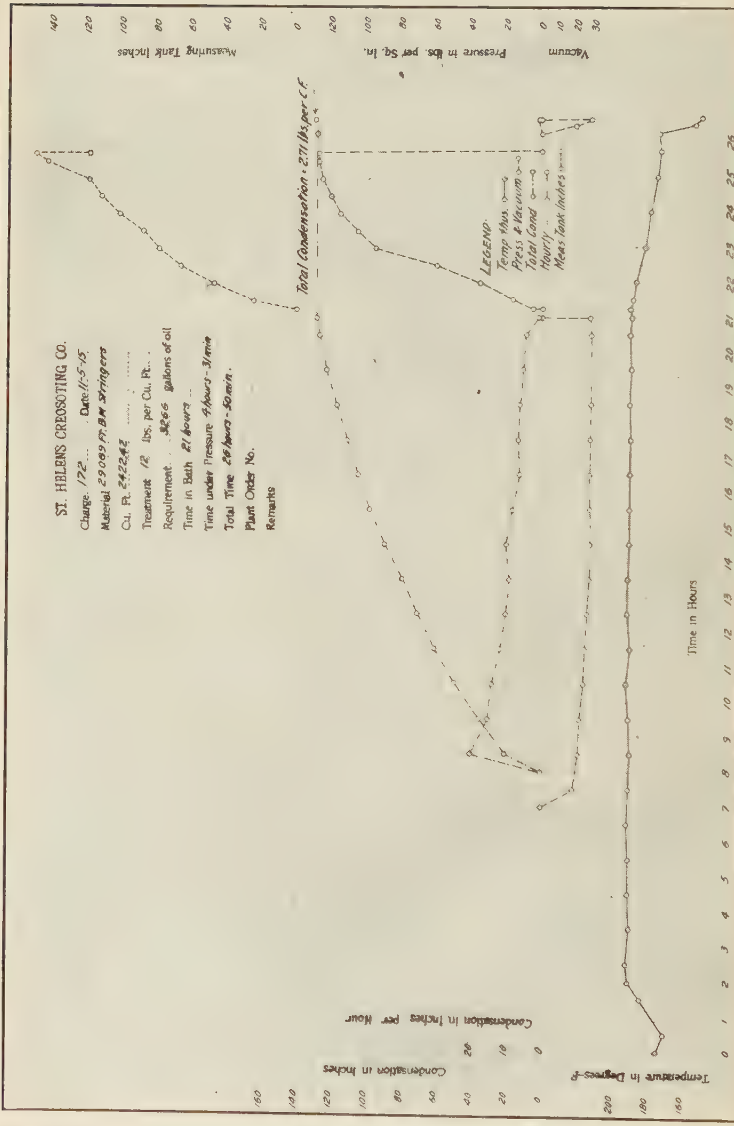

ST. HELENS CREOSOTING CO.
Charge 172 Date 11-5-15
Material 29089 Ft. B.M. Stringers
Cu. Ft. 2422.42
Treatment 12 lbs. per Cu. Ft.
Requirement 3266 gallons of oil
Time in Bath 21 hours
Time under Pressure 4 hours - 31 min
Total Time 26 hours - 50 min.
Plant Order No.
Remarks
Total Condensation = 2.71 lbs. per C.F.
LEGEND:
Temp thus.
Press & Vacuum
Total Cond
Hourly
Meas Tank Inches
Measuring Tank Inches
Pressure in lbs. per Sq. In.
Vacuum
Condensation in Inches per Hour
Condensation in Inches
Temperature in Degrees-F
Time in Hours

TABLE 13

BRIDGE STRINGERS

EFFECT OF CREOSOTING BY "BOILING UNDER A VACUUM" ON THE STRENGTH AND STIFFNESS OF DOUGLAS FIR, TREATED GREEN. TIMBERS 7"x14"x14'. TESTED UNDER ⅓ POINT LOADING ON A 13' SPAN.

NUMBER	MARK	RINGS PER INCH		FIBRE STRESS AT ELASTIC LIMIT LBS. PER SQ IN			MODULUS OF RUPTURE LBS PER SQ IN.			MODULUS OF ELASTICITY 1000 LBS PER SQ IN			MAXIMUM HORIZONTAL SHEAR DEVELOPED LBS PER SQ IN			MANNER OF FAILURE	
		N	T	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T
1	4-A-2	13	13	4620	4140	89.6	7330	5780	78.9	1970	1730	87.8	503	393	78.3	TENSION & HOR SHEAR	TENSION & HOR SHEAR
6	A-1			4190	4550	108.5	6083	6291	103.3	1700	1587	93.4	415	426	102.5	TENSION	TENSION & HOR SHEAR
7	1-A-2	11	11	4140	4490	108.3	6070	6730	110.9	1857	1845	99.4	415	458	110.0	HORIZONTAL SHEAR	HOR SHEAR & TENSION
9	5-A-2	12	13	3930	4040	103.0	5500	5390	98.0	1779	1760	98.9	377	366	97.0	TENSION & HOR SHEAR	TENSION & HOR SHEAR
10	A-5	7	7	3720	3900	104.8	5422	5620	103.7	1696	1545	91.1	371	383	103.2	TENSION	TENSION & HOR SHEAR
11	A-2	10	10	3680	3375	91.7	5328	4980	93.3	1295	1513	116.8	363	339	93.4	TENSION	HORIZONTAL SHEAR
14	A-3	10	9	3685	4105	111.3	4605	5440	118.2	1885	1760	93.4	314	369	117.5	TENSION	TENSION
15	A-4	12	14	3070	2885	94.0	4410	4750	107.7	1187	1266	106.7	298	319	107.0	TENSION	TENSION
16	3-A-2	11	11	3920	3190	81.4	4408	4725	107.2	1450	1420	97.0	302	324	110.8	TENSION	TENSION
AVG.		10.8	11.0	3884	3853	99.2	5460	5523	101.2	1647	1603	97.3	373	375	100.5		

CITY OF PORTLAND, OREGON
DEPARTMENT OF PUBLIC WORKS
BUREAU OF STANDARDS

TABULATION OF RESULTS
OF TRANSVERSE BENDING ON NATURAL AND TREATED STRINGERS

COMPUTED BY {OB / JOB} DEC .5, '9.5.

Results of bending tests made on 7"x14"x14' Douglas fir bridge stringers, natural and creosoted.

TABLE 13

BRIDGE STRINGERS

EFFECT OF CREOSOTING BY "BOILING UNDER A VACUUM" ON THE STRENGTH AND STIFFNESS OF DOUGLAS FIR, TREATED GREEN. TIMBERS 10"X14"X14'. TESTED UNDER $\frac{1}{3}$ POINT LOADING ON A 13' SPAN

NUMBER	MARK	RINGS PER INCH		FIBRE STRESS AT ELASTIC LIMIT LBS PER SQ. IN.			MODULUS OF RUPTURE LBS PER SQ. IN			MODULUS OF ELASTICITY 1000 LBS PER SQ. IN.			MAXIMUM HORIZONTAL SHEAR DEVELOPED LBS. PER SQ. IN			MANNER OF FAILURE	
		N	T	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T
2	A-9	13	13	5740	3580	62.4	6700	5550	82.8	2019	1863	92.3	456	375	82.2	HORIZONTAL SHEAR	TENSION
3	A-7	15	15	4420	3480	78.7	6210	4900	78.9	1739	1538	88.4	423	330	78.0	HORIZONTAL SHEAR	HORIZONTAL SHEAR
5	A-10	12	12	5190	5420	104.5	6130	6780	110.6	1702	1757	103.2	418	459	109.8	HORIZONTAL SHEAR	TENSION & HOR. SHEAR
8	A-8	8	8	5580	5430	97.3	5880	6280	106.8	1824	1750	95.9	403	425	105.5	HORIZONTAL SHEAR	TENSION
12	A-6	12	12	3420	3050	89.2	5280	5160	97.7	1463	1395	95.4	359	350	97.5	TENSION	HORIZONTAL SHEAR
AVG		12	12	4870	4192	86.1	6040	5734	95.0	1749	1661	94.9	412	388	94.2		

TABLE 14

STRINGERS 7"X16"X15' – 14' SPAN

NUMBER	MARK	RINGS N	RINGS T	FIBRE STRESS N	FIBRE STRESS T	% OF NATURAL	RUPTURE N	RUPTURE T	% OF NATURAL	ELASTICITY N	ELASTICITY T	% OF NATURAL	SHEAR N	SHEAR T	% OF NATURAL	FAILURE N	FAILURE T
4	A-11	16	16	4225	4385	103.8	6190	6145	99.3	2032	1915	94.2	460	463	100.7	HORIZONTAL SHEAR	HORIZONTAL SHEAR
13	A-12	13	13	3858	3815	98.9	5275	5530	104.7	1815	1726	95.1	381	397	104.2	HORIZONTAL SHEAR	HORIZONTAL SHEAR
AVG.		14.5	14.5	4042	4100	101.4	5733	5838	101.8	1924	1821	94.6	421	430	102.2		

CITY OF PORTLAND, OREGON
DEPARTMENT OF PUBLIC WORKS
BUREAU OF STANDARDS

TABULATION OF RESULTS
OF TRANSVERSE BENDING ON
NATURAL AND TREATED STRINGERS.

COMPUTED BY {O B / J O B   DEC. 15 1915.

Results of bending tests made on 10"x14"x14' and 7"x16"x15' Douglas fir bridge stringers, natural and creosoted.

TABLE 16

BRIDGE STRINGERS

EFFECT OF CREOSOTING BY "BOILING UNDER A VACUUM" ON THE STRENGTH AND STIFFNESS OF DOUGLAS FIR, TREATED GREEN. TIMBERS 7"x14"x 4', 7"x 6"x15' AND 10"x14"x14'. TESTED UNDER ⅓ POINT LOADING ON A 13' TO 14' SPAN.

NUMBER	MARK	RINGS PER INCH		FIBRE STRESS AT ELASTIC LIMIT LBS. PER SQ IN.			MODULUS OF RUPTURE LBS PER SQ IN.			MODULUS OF ELASTICITY 1000 LBS PER SQ IN			MAXIMUM HORIZONTAL SHEAR DEVELOPED LBS PER SQ IN			MANNER OF FAILURE	
		N	T	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T	% OF NATURAL	N	T
1	4-A-2	13	13	4620	4140	89.6	7330	5780	78.9	1970	1730	87.8	503	393	78.3	TENSION & HOR SHEAR	TENSION & HOR SHEAR
2	A-9	13	13	5740	3580	62.4	6700	5550	82.8	2019	1863	92.3	456	375	82.2	HORIZONTAL SHEAR	TENSION
3	A-7	15	15	4420	3480	78.7	6210	4900	78.9	1739	1538	88.4	423	330	78.0	HORIZONTAL SHEAR	HORIZONTAL SHEAR
4	A-11	16	16	4225	4385	103.8	6190	6145	99.3	2032	1915	94.2	460	463	100.7	HORIZONTAL SHEAR	HORIZONTAL SHEAR
5	A-10	12	12	5190	5420	104.5	6130	6780	110.6	1702	1757	103.2	418	459	109.8	HORIZONTAL SHEAR	TENSION & HOR SHEAR
6	A-1	—	—	4190	4550	108.5	6083	6291	103.3	1700	1587	93.4	415	426	102.5	TENSION	TENSION & HOR SHEAR
7	1-A-2	11	11	4140	4490	108.3	6070	6730	110.9	1857	1845	99.4	415	458	110.0	HORIZONTAL SHEAR	HOR SHEAR & TENSION
8	A-8	8	8	5580	5430	97.3	5880	6280	106.8	1824	1750	95.9	403	425	105.5	HORIZONTAL SHEAR	TENSION
9	5-A-2	12	13	3930	4040	103.0	5500	5390	98.0	1779	1760	98.9	377	366	97.0	TENSION & HOR SHEAR	TENSION & HOR. SHEAR
10	A-5	7	7	3720	3900	104.8	5422	5620	103.7	1696	1545	91.1	371	383	103.2	TENSION	TENSION & HOR SHEAR
11	A-2	10	10	3680	3375	91.7	5328	4980	93.3	1295	1513	116.8	363	339	93.4	TENSION	HORIZONTAL SHEAR
12	A-6	12	12	3420	3050	89.2	5280	5160	97.7	1463	1395	95.4	359	350	97.5	TENSION	HORIZONTAL SHEAR
13	A-12	13	13	3858	38.5	98.9	5275	5530	104.7	1815	1726	95.1	381	397	104.2	HORIZONTAL SHEAR	HORIZONTAL SHEAR
14	A-3	10	9	3685	4105	111.3	4605	5440	118.2	1885	1760	93.4	314	369	117.5	TENSION	TENSION
15	A-4	12	14	3070	2885	94.0	4410	4750	107.7	1187	1266	106.7	298	319	107.0	TENSION	TENSION
16	3-A-2	11	11	3920	3190	81.4	4408	4725	107.2	1450	1420	97.9	302	324	110.8	TENSION	TENSION
AVG.		11.7	11.8	4212	3990	94.8	5676	5628	99.2	1713	1648	96.3	392	386	98.6		

CITY OF PORTLAND, OREGON
DEPARTMENT OF PUBLIC WORKS
BUREAU OF STANDARDS

TABULATION OF RESULTS
OF TRANSVERSE BENDING ON NATURAL AND TREATED STRINGERS

COMPUTED BY {O.B. / J.O.B. DEC 15.1915.

Results of bending tests made on 7"x14"x14', 10"x14"x14' and 7"x16"x15' Douglas fir bridge stringers, natural and creosoted.

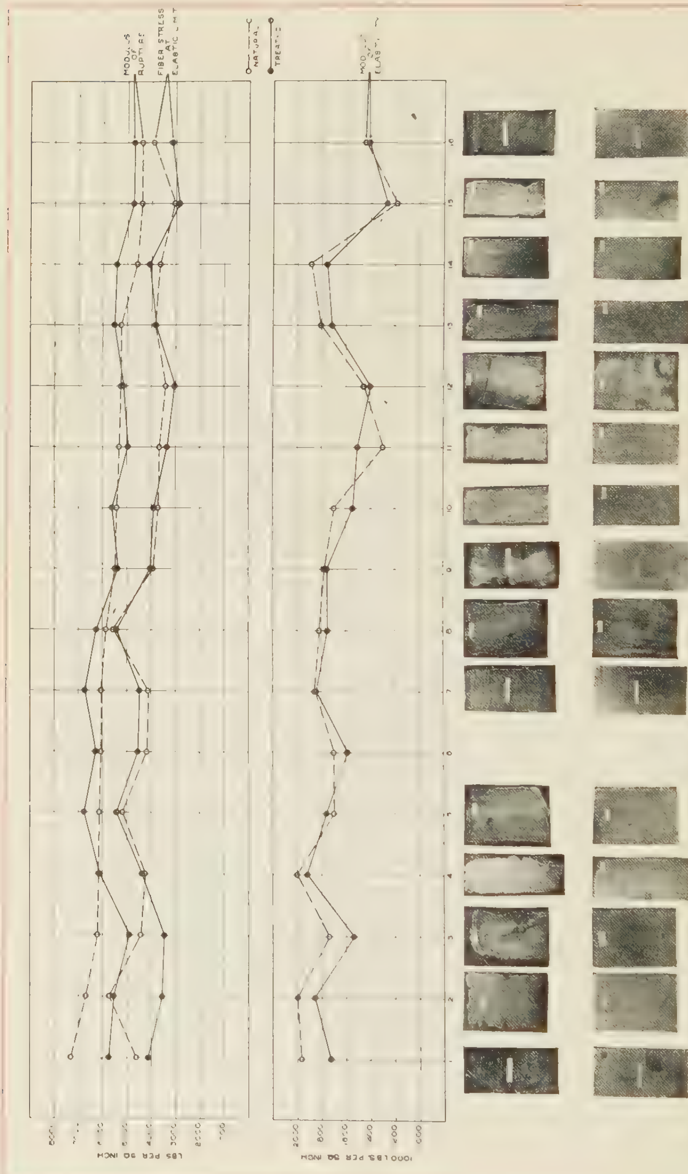


Diagram 5. Relation between the Modulus of Rupture, Modulus of Elasticity and Fiber Stress at Elastic Limit, of natural and creosoted bridge stringers of Douglas fir. Cross-section of natural and treated stringers also shown. Note creosote oil penetration in sections in upper row.

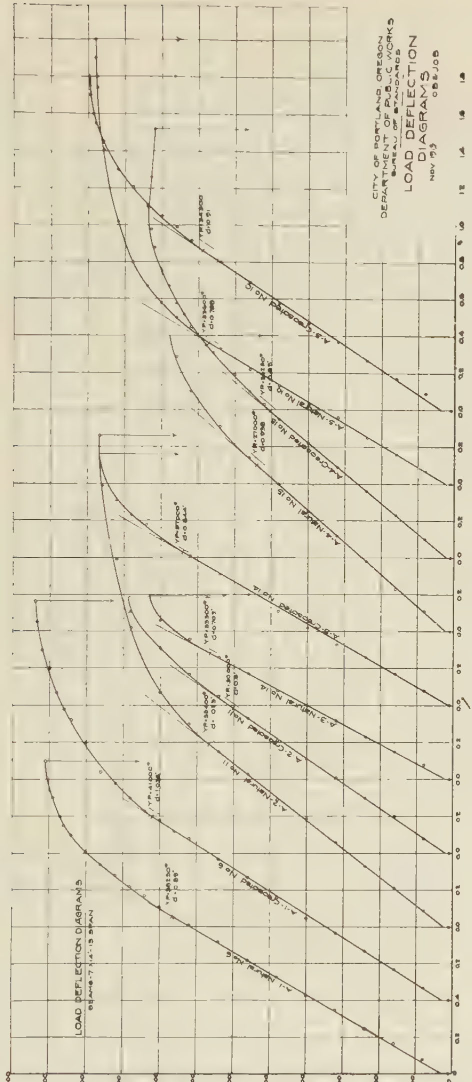


Diagram 6. Load-deflection diagrams for 7″x14″x14′ Douglas fir bridge stringers, natural and creosoted.

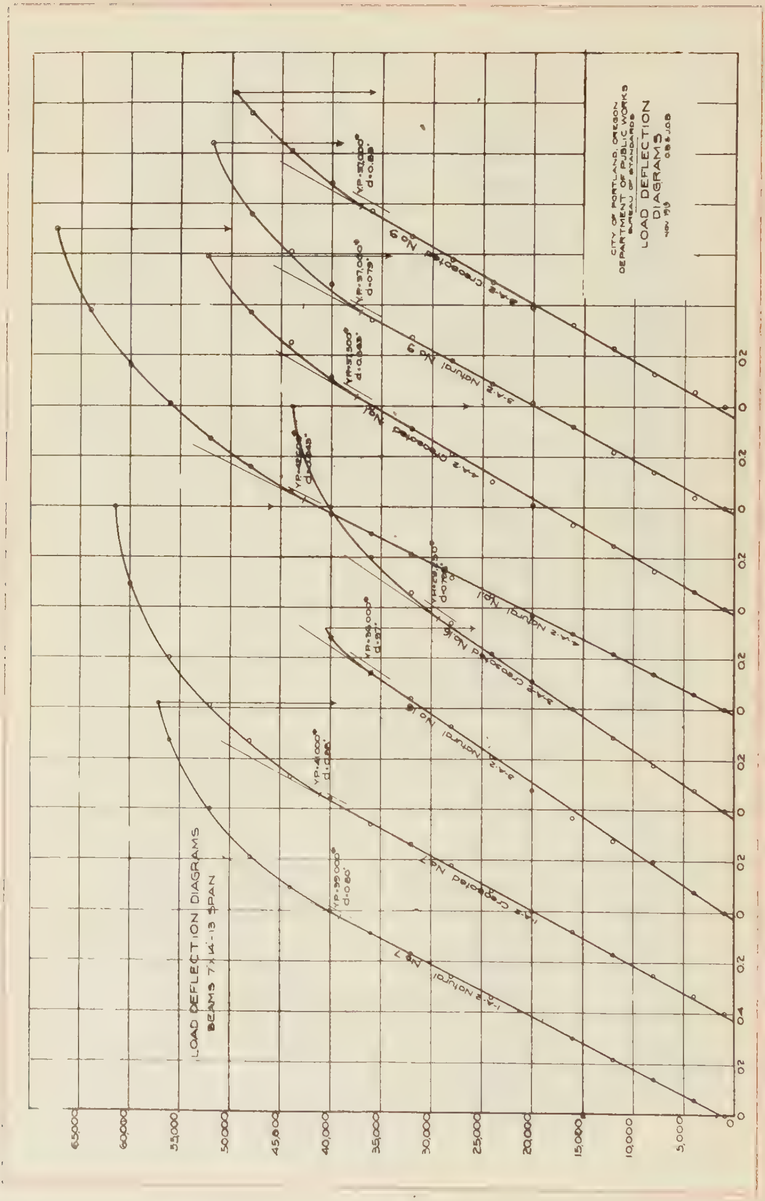


Diagram 7. Load-deflection diagrams for 7"x14" Douglas fir bridge stringers, natural and creosoted

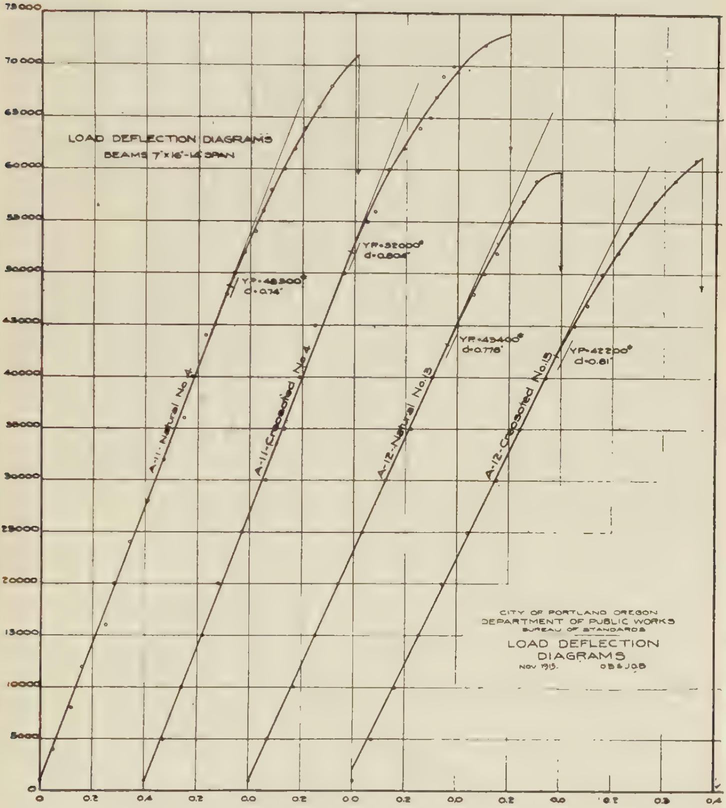


Diagram 8. Load-deflection diagrams for 7"x16"x15' Douglas fir bridge stringers, natural and creosoted.

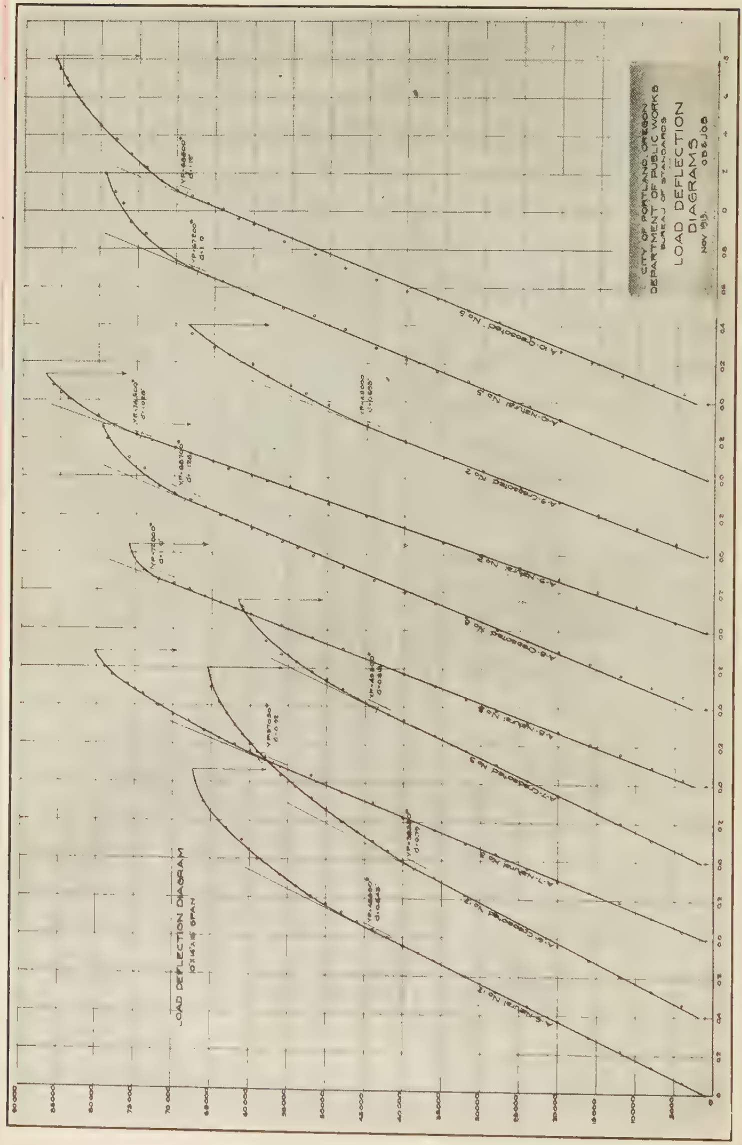


Diagram 9. Load-deflection diagrams for 10"x14"x14 Douglas fir bridge stringers, natural and creosoted.

These tests show that the treatment used does not cause any appreciable loss in the strength of full size bridge stringers.

Approved by

Signed R. G. DIECK
Commissioner of Public Works

Signed R. S. DULIN
Chief, Bureau of Standards.

Tables 13 to 16 and diagrams 6 to 9 are part of the above report by the Bureau of Standards, City of Portland.

The results of the above tests are also shown graphically in diagram 5. The untreated timbers were arranged in order of their strength based on the modulus of rupture, and plotted with the strongest timber to the left and the weakest timber to the extreme right of the diagram. Three factors are shown, as follows:

Modulus of Rupture;
Fiber Stress at Elastic Limit;
Modulus of Elasticity.

The results of the treated and corresponding natural stringers are plotted on the same vertical line and are very close together for all of these factors. At the bottom of the diagram sections of both the treated and untreated stringers are shown. These sections show the penetration obtained and give an idea of the class of material used in these tests. The minimum penetration was 0.4 inch and the maximum 2.25 inches with an average of approximately 1.2 inches.

The above results are proof that Douglas fir bridge stringers may be effectively creosoted without injuring the strength, a fact which should be of interest to railroads and others consumers of structural timber.

TIES. The volume of lumber which is cut annually into railroad ties is extremely large. There is perhaps no form of timber which is subjected to a more strenuous test than a railroad tie. In the first place, a tie is so placed as to make it subject to attack by fungus. In the second place, a tie is stressed in a direction perpendicular to the grain. Practically no test on wood shows as low unit strength as the test in compression perpendicular to the grain. Therefore, a tie in order to best serve its purpose should at all times retain its natural strength.

An untreated tie shows its natural strength only up to the point when it begins to decay. The mechanical life of a Douglas fir tie of good grade is at least 15 years, but under conditions found in the ordinary roadbed, this class of ties will decay and become useless in from six to seven years.

In an effort to overcome decay, a great many creosoted Douglas fir ties have been used. These ties, however, were creosoted by the boiling or steaming processes both of which employed high temperatures and produced a weakening of 30 to 40 per cent in the strength of the wood. It is very evident that this weakening was extremely serious. As mentioned before, wood is weak in compression perpendicular to the grain. To make it still weaker by methods of creosoting which injure its strength, is extremely objectionable when the wood is to be used in the form of ties. Many ties which have been treated by the use of high temperatures and placed in the track have shown weakness in resisting the impact of railway traffic. Such ties have shown marked improvement in their durability, but great weakness against mechanical wear.

In view of the above facts, the West Coast Lumbermen's Association has made a careful study of this subject in an effort to solve the difficulties. Two principal points have been held in mind during the experiments made to date:

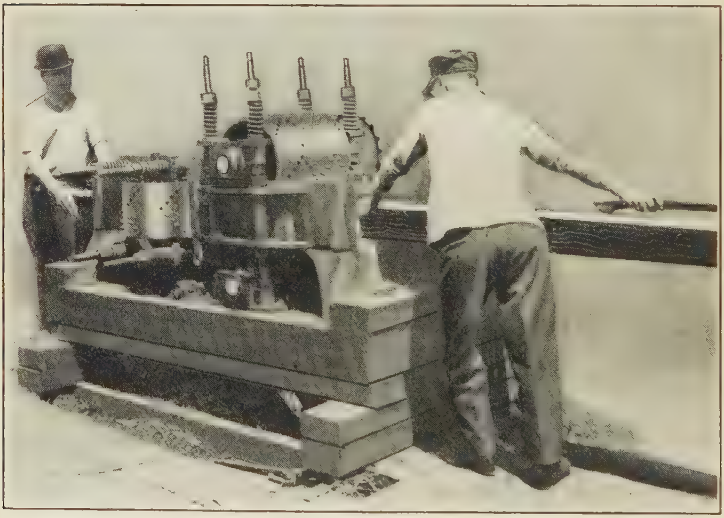


Fig. 4. A machine used to perforate Douglas fir railway ties in order to better distribute the preservative, thus securing a more effective protection against decay. These perforations make the treatment of the tie possible without the application of high temperatures and pressures.

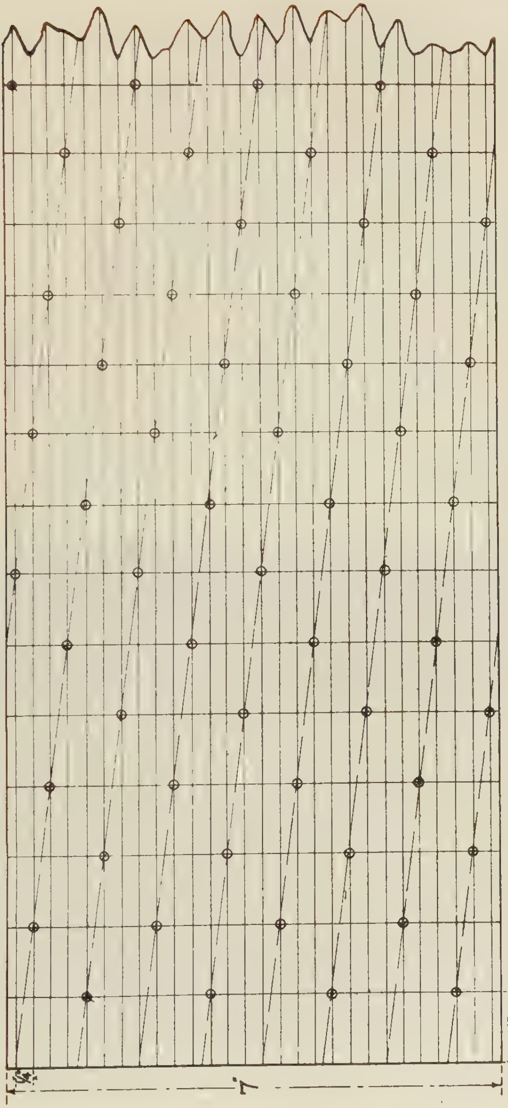


Fig. 5. A spacing of perforations in a tie, which will give complete penetration of the preservative to the full depth of the perforations.

(1) To prolong the natural life of Douglas fir ties by preservative treatment.

(2) To apply the preservative treatment effectively without injuring the strength of the wood.

The accomplishment of the above points will produce the desired result, since Douglas fir, in comparison to other woods, is very strong in compression perpendicular to the grain.

In investigating this subject an effort has been made to take advantage of the fact that creosote oil enters wood along the grain with very much greater ease than in any other direction. It was therefore decided to perforate the timber to the desired depth of penetration and allow the oil to enter the wood with the least possible resistance. The question which naturally arose was whether or not this perforating could be done commercially.

The Columbia Creosoting Company of Portland, Oregon, took this matter up, and designed and built a machine for perforating ties. The photograph on page 50 gives some idea of the design of this machine.

The machine runs at a speed of approximately 70 feet per minute, and will perforate ties as rapidly as it is possible for la-

Perforated Side.

Unperforated Side.

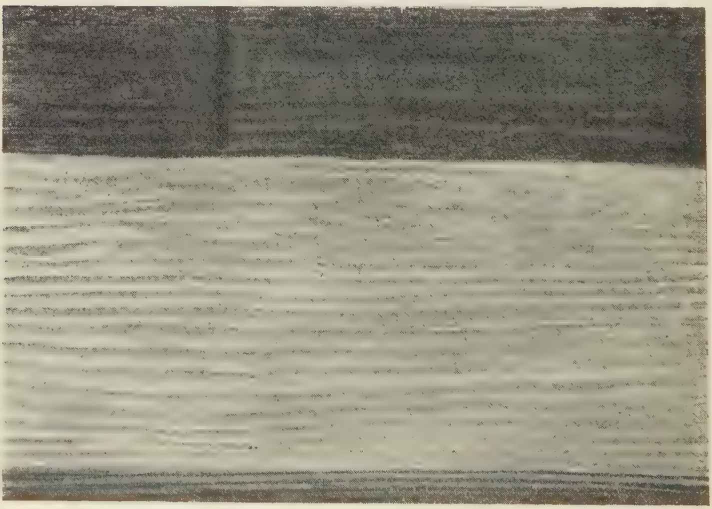


Fig. 6. A piece of Douglas fir which has been perforated on one side only. This shows that by means of perforations the penetration and distribution of creosote oil can be absolutely controlled.

RESULTS OF TESTS IN COMPRESSION PERPENDICULAR TO GRAIN ON DOUGLAS FIR TIE SECTIONS—NATURAL, UNPERFORATED-CREOSOTED AND PERFORATED-CREOSOTED

7″x8″x30″

AIR-SEASONED MATERIAL

Tests made for the Association of Creosoting Companies of the Pacific Coast.

TABLE 17

Tie Number	Number of Tests			Compressive Strength at Elastic Limit per Sq. In.			Relative Strength of		
	Natural	Unperforated-Creosoted	Perforated-Creosoted	Natural	Unperforated-Creosoted	Perforated-Creosoted	Unperforated-Creosoted in Per Cent of Natural. Natural=100 per cent	Perforated-Creosoted in Per Cent of Natural. Natural=100 per cent	Perforated-Creosoted in Per Cent of Unperforated-Creosoted. Unperforated-Creosoted=100 per cent
				Lbs.	Lbs.	Lbs.	Per Cent	Per Cent	Per Cent
1	1	1	1	684	595	567	87.0	82.9	95.3
2	1	1	1	464	604	570	130.2	122.9	94.4
3	1	1	1	434	552	513	127.2	118.2	93.0
4	1	1	1	554	558	516	100.7	93.1	92.5
5	1	1	1	390	498	487	127.7	124.9	97.8
Average	....	....	....	505	561	531	111.0	105.2	94.7

borers to handle them. The vertical rolls perforate the sides, and the horizontal rolls the top and bottom faces. The ties should, of course, be bored for spikes before treatment.

A good spacing for the perforations is shown by Fig. 5. It will be noted that these perforations are so arranged that it is only necessary for the creosote to pass along the grain a distance of 3½ inches from each perforation, in order to give complete penetration on all faces of the tie, to a depth equal to that of the perforations.

Fig. 6 shows the results of creosoting perforated Douglas fir. One side of the specimen shown was perforated and the other side was treated in its natural condition. Note the even distribution of oil in the perforated side and the increased depth of penetration.

The question as to the effect of the perforating upon the strength of the wood came up immediately for consideration. For the purpose of securing reliable data on this point, strength tests were made on ties in both the natural and treated conditions.

Table 17 gives results of tests on three classes of material, namely, air-seasoned, natural, unperforated-creosoted and perforated-creosoted. The creosoted ties were treated by the "Boiling Under Vacuum Process."

The average results of these tests show the creosoted sections to be stronger than the natural.

In order to secure additional data on this subject it was decided to make further tests on ties perforated and treated by this method. The following report on the results of these tests gives reliable data on the effect of this method of perforating upon the strength of Douglas fir ties.

City of Portland
Department of Public Works
Bureau of Standards

Report of side compression test of creosoted tie sections. Tested for O. P. M. Goss, consulting engineer for the Association of Creosoting Companies of the Pacific Coast.

Purpose. To determine the effect of perforations on the strength of creosoted railroad tie sections in compression perpendicular to the grain.

Material. The material consisted of Douglas fir, merchantable grade, of the following dimensions:

10—10″x4½″x5′.

One-half of each tie was perforated the other half being

unperforated. They were selected so that the two halves of each tie were of as nearly equal quality as it was possible to obtain. Each tie was treated by the "Boiling Under a Vacuum Process." After treatment the 20 sections were brought to Portland, Oregon, and tested by the Bureau. The test was applied to the corresponding side in each pair.

METHOD OF TESTS. The tie sections were tested on a 150,000 pound Universal Riehle Testing Machine. The specimen was placed on the bed of the testing machine and a steel compression plate 8″x12″x1¼″ was placed crosswise on the specimen. A 10-inch spherical compression tool was placed between the head of the testing machine and the steel compression plate to insure equal distribution of the load. The dimensions of the specimens were taken at the center directly under the compression plate.

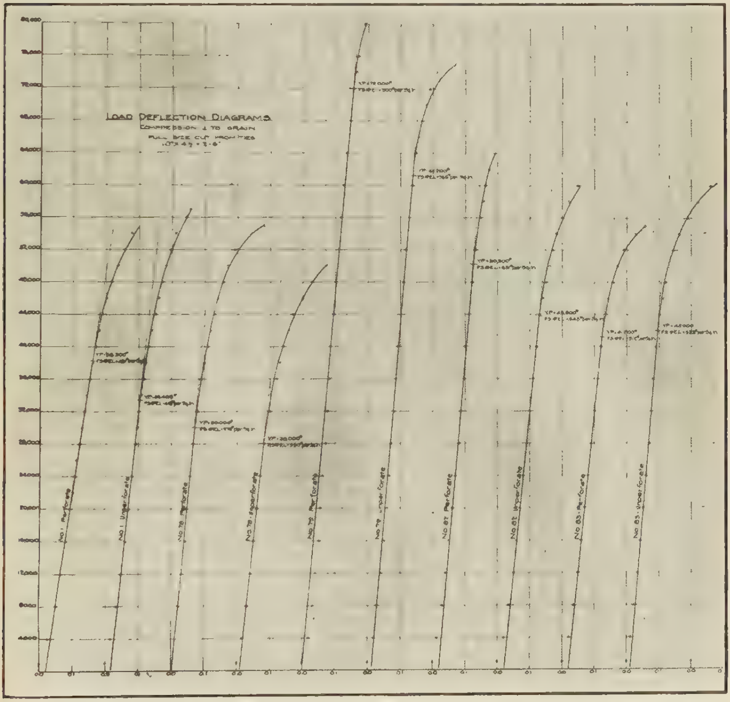


Diagram 10. Load-deflection diagrams for creosoted Douglas fir ties, perforated and unperforated. Tests made in compression perpendicular to grain.

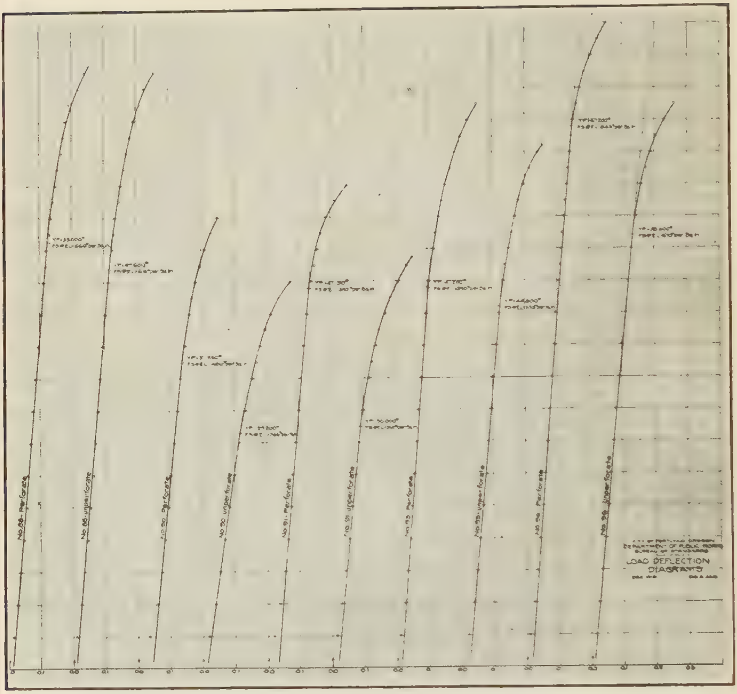


Diagram 11. Load-deflection diagrams for creosoted Douglas fir ties, perforated and unperforated. Tests made in compression perpendicular to grain.

being averages of two readings. The area of compression was 8 inches times the width of the specimen. An initial load of 1,000 pounds was applied to each section, after which the deflection reading apparatus, an Olsen Improved Deflectometer reading to 0.001 of an inch, was adjusted to zero reading when the load was applied continuously to well beyond the yield point. The rate of application of the load was 0.046 inch per minute.

RESULTS. The load deflection diagrams* and table* of results are attached.

Date of Tests: Tests made on November 26 and 27, 1915.

Observers:

Oscar Beck John O. Baker

Approved by

Signed R. G. DIECK *Signed* R. S. DULIN
Commissioner of Public Works Chief, Bureau of Standards

*Refers to diagrams 10 and 11 and to table 18.

RESULTS OF TESTS IN COMPRESSION PERPENDICULAR TO GRAIN ON CREOSOTED DOUGLAS FIR TIE SECTIONS

10″x4.5″x2′-6″

Tests made by the Bureau of Standards, Portland, Oregon.

TABLE 18

Tie Number	Rings per Inch		Compressive Strength at Elastic Limit per Sq. In.		
	Unperforated	Perforated	Unperforated	Perforated	Strength of Perforated in Per Cent of Unperforated. Unperforated = 100 per cent
			Lbs.	Lbs.	Per Cent
1	6	6	419	481	114.8
78	9	9	350	376	107.5
79	9	9	765	900	117.6
82	7	7	545	631	115.8
83	6	6	523	512	97.9
88	6	6	616	666	108.1
90	9	9	366	480	131.1
91	5	5	375	595	158.6
93	7	7	555	590	106.3
96	7	7	670	845	126.1
Average.....	7.1	7.1	518	608	117.4

The table of results contained in this report shows the perforated ties to be 117.4 per cent as strong as the unperforated. In only one individual case is the unperforated piece stronger than the corresponding perforated section and in most instances the increase in strength due to perforation is marked. Thorough penetration was secured in all the ties by means of this method of perforation. These results correspond very closely to previous tests on perforated material and prove that by the proper method of perforation it is possible to creosote Douglas fir ties, distributing the oil where wanted and without loss in strength in the wood.

A good method of preparing for the treatment of railroad ties of Douglas fir or western hemlock would be as follows:

Cut ties in winter and early spring. Perforate and open-pile for air seasoning, taking advantage of the summer months. The ties may then be treated during the fall and winter. Handling ties in this way will insure an absolute protection against decay, and will enable the wood to be creosoted without loss in mechanical strength. These two points will insure the greatest value possible in the way of service, from this form of material.

Spike Pulling Tests. The relative value of the various species of wood used for ties has been the cause of considerable discussion in the past, particularly with regard to the holding

power of railroad spikes in these woods. With the increasing use of creosoted ties the screw spike is likewise becoming more popular, as the increased length of life of treated ties warrants the use of a more permanent method of rail fastening.

In order to determine the holding force of spikes under various conditions in natural and treated timber, the Seattle Timber Testing Laboratory of the U. S. Forest Service recently made a series of spike pulling tests on natural and creosoted commercial Douglas fir railway ties. Permission to publish the results of these tests has been granted through the courtesy of the Forest Service.

The test material consisted of 18 commercial grade Douglas fir ties, two sections of each tie being used for these tests. Both common and screw spikes were pulled from these sections, one of which was green and the other creosoted. Holes ranging in size from ⅜ to ⅝ inch were bored in each tie, those in the creosoted ties being bored before treatment.

Table 19 contains the complete results of these tests.

The following points are mentioned in connection with the use of this table:

(1) The form of the point of the common spike is such that it inclines not to follow the hole.

(2) Care was exercised in these tests to have the spikes follow the holes.

(3) If the holes are not too large (three-eights inch or seven-sixteenths inch) and the spikes follow the holes closely the resistance to withdrawal will usually be increased.

(4) If spikes do not follow the holes the resistance to withdrawal may be greatly reduced.

(5) Spikes driven close to the holes but not into them will have their resistance lowered.

(6) The splitting of the tie and the breaking of the fiber is reduced when the spikes are driven into bored holes.

In the tests on the holding power of common spikes the results for the treated and natural material show very little difference. In the natural wood the spikes driven into the ⅜-inch holes showed the greatest holding power, while in the treated those driven into the ½-inch holes required the greatest force to pull them from the timber. The screw spikes, which were placed in ⅝-inch holes, pulled considerably harder from the creosoted than from the natural ties.

TABLE SHOWING HOLDING FORCE OF COMMON AND SCREW SPIKES IN NATURAL AND TREATED DOUGLAS FIR TIES—GREEN MATERIAL

TABLE 19 Data furnished by the Seattle Timber Testing Laboratory of the U. S. Forest Service.

Reference Number	Specific Gravity Ovendry Based on Green Volume	Rings per Inch	Summer-wood	Moisture Content	Natural Ties						Moisture Content	Treated Ties					
					Force Required to Pull Spike							Force Required to Pull Spike					
					Common Spikes					Screw Spikes		Common Spikes					Screw Spikes
					Mark A No Hole	Mark B 3/8" Hole	Mark C 7/16" Hole	Mark D 1/2" Hole	Mark E 9/16" Hole	Mark F 5/8" Hole		Mark A No Hole	Mark B 3/8" Hole	Mark C 7/16" Hole	Mark D 1/2" Hole	Mark E 9/16" Hole	Mark F 5/8" Hole
			Per Cent	Per Cent	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Per Cent	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	0.428	5.0	20	33.0	4470	4910	3760	3740	3100	7450	....	3510	4190	4480	3800	3300	12430
2	0.461	10.0	30	32.8	4450	4950	5010	5120	4580	10660	26.0	5040	5490	4240	4580	4540	12540
3	0.452	9.0	20	31.2	5020	4540	5250	3570	3040	8670	....	3280	3300	3440	3960	3920	10270
4	0.456	7.5	30	39.2	4530	4790	4150	3880	3650	8670	....	4920	5420	4450	4650	3930	10870
5	0.531	50.0	45	32.2	4560	5660	5230	4120	4720	9090	23.8	4480	5400	5760	6320	3840	11280
6	0.437	7.0	20	35.7	4230	4160	4160	4000	3050	9290	....	4040	4430	3870	4300	4160	8500
7	0.370	4.0	18	35.0	3000	4100	3960	4130	3100	9560	....	2990	2940	3260	2770	2710	7990
8	0.482	14.0	28	31.8	4990	5600	4980	5090	3470	11220	23.6	4980	5360	5940	5270	3290	14050
9	0.379	7.0	20	34.7	4440	3470	3500	2950	3320	7040	32.1	3090	3050	3150	3050	2650	8490
10	0.438	16.0	30	32.6	3510	4150	4570	3380	3450	8380	....	3310	3800	3650	3400	3070	8130
11	0.438	11.0	35	32.7	4150	4030	3940	3720	3100	8100	....	3530	4990	3880	4970	4210	7390
12	0.465	10.0	36	33.0	4770	4050	5450	5480	4520	9420	25.7	4670	4700	4880	6200	4190	11240
13	0.444	9 0	30	31.8	4610	4010	3940	3480	3270	7360	....	3800	2870	3840	3500	3790	8560
14	0.483	11.0	37	34.7	5800	4720	5330	3940	4920	10100	24.7	4860	4350	3660	5130	4120	11520
15	0.414	9.5	30	31.8	3720	3470	2910	2860	2750	8320	....	3840	3940	4270	4490	2960	10280
16	0.457	8.0	25	33.6	4650	5990	4710	4550	3340	9130	....	4510	4210	6080	4380	4470	8630
17	0.509	46.0	42	32.2	5070	5820	4820	4800	4530	9370	....	5000	4540	4500	4360	3960	8500
18	0.481	11.0	40	32.3	6020	4870	5460	5260	3710	9580	....	5050	4380	4980	5400	4890	12610
Average	0.451	13.6	30	33.3	4555	4627	4507	4115	3646	8967	25.7	4160	4298	4352	4474	3778	10182
Maximum	0.531	50.0	45	39.2	6020	5990	5460	5480	4920	11220	32.1	5050	5490	6080	6320	4890	14050
Minimum	0 370	4.0	18	31.2	3000	3470	2910	2860	2750	7040	23.6	2990	2870	3150	2770	2650	7390

The results of these tests together with those on the perforation of Douglas fir show marked progress in the preservation and utilization of creosoted Douglas fir railway ties and should encourage the use of this wood for tie purposes, to which it is unusually well adapted.

FORMULAE FOR RECTANGULAR BEAMS

The symbols below are used in all the following formulae:

l = Length of span, in inches.

b = Width of beam, in inches. (In mill and laminated floor computations, b = 12 inches.)

h = Height of beam, in inches.

V = Maximum vertical shear, in pounds.

J = Maximum unit horizontal shear, in pounds per square inch.

J′ = Allowable unit horizontal shear (any safe value), in pounds per square inch.

I = Moment of inertia of cross section of beam about neutral axis, in inches^4.

A = Area of cross section of beam, in square inches.

S = Section modulus, in inches^3.

n = Distance from neutral axis to extreme fiber in inches. For a rectangular beam this equals one-half the height of beam.

f = Safe unit stress, extreme fiber, in pounds per square inch.

E = Modulus of elasticity, in pounds per square inch.

d = Maximum deflection, in inches.

D = Deflection equivalent to $\frac{1}{32}$ inch per foot of span.

w = Load on beam per foot of span, in pounds.

W = Total load on beam $\left(\frac{w\,l}{12}\right)$, in pounds.

M = Maximum external bending moment; also the internal resisting moment of the beam cross section; in inch pounds.

L′ = Total floor load per square foot, in pounds. Equals live load per square foot plus weight of floor per square foot. Used in computing maximum span tables for mill and laminated floors.

$$I = \frac{bh^3}{12} \qquad S = \frac{I}{n} = \frac{bh^2}{6} \qquad M = fS$$

MAXIMUM UNIT HORIZONTAL SHEAR IN RECTANGULAR BEAMS

When a beam is loaded the horizontal shear which is developed produces a tendency to split along the neutral axis*. The formula for maximum unit horizontal shear in a rectangular beam is:

$$J = 1.5\left(\frac{V}{bh}\right)$$

* The neutral axis of a rectangular beam is in a plane separating the upper and lower halves when the beam is horizontal.

When a rectangular beam is symmetrically loaded the maximum vertical shear, V, is $\left(\frac{W}{2}\right)$ and therefore the maximum unit horizontal shear is:

$$J = 0.75\left(\frac{W}{bh}\right)$$

From this formula it is seen that the maximum unit horizontal shear varies directly with the load. For a given fiber stress "f" (say 1,000 lbs. per sq. in.), developed in a beam, the safe load, W, for center loading is one-half that for uniform loading, and for third-point loading it is three-fourths of that for uniform loading. Therefore, the maximum unit horizontal shear for center loading is one-half of the horizontal shear for uniform loading and for third-point loading it is three-fourths of that for uniform loading.

SAFE LOADS LIMITED BY HORIZONTAL SHEAR

The safe load, W, in pounds, on a beam, limited by any given safe unit horizontal shearing stress, J′, pounds per square inch, may be found by the formula:

$$W = \frac{J'bh}{0.75}$$

SAFE LOADS ON BEAMS (CONSIDERING BENDING ONLY)

Center Loading:

$$\frac{fI}{n} = M = \left(\frac{W}{2}\right)\left(\frac{l}{2}\right) = \frac{Wl}{4}$$

$$W = \frac{4fI}{ln} = \frac{4f}{l}\left(\frac{bh^2}{6}\right) = ⅔\left(\frac{fbh^2}{l}\right)$$

Third Point Loading:

$$\frac{fI}{n} = M = \left(\frac{W}{2}\right)\left(\frac{l}{3}\right) = \frac{Wl}{6}$$

$$W = \frac{6fI}{ln} = \frac{6f}{l}\left(\frac{bh^2}{6}\right) = \left(\frac{fbh^2}{l}\right)$$

Uniform Loading:

$$\frac{fI}{n} = M = \left(\frac{W}{2}\right)\left(\frac{l}{2}\right) - \left(\frac{W}{2}\right)\left(\frac{l}{4}\right) = \frac{Wl}{8}$$

$$W = \frac{8fI}{ln} = \frac{8f}{l}\left(\frac{bh^2}{6}\right) = \frac{4}{3}\left(\frac{fbh^2}{l}\right)$$

MAXIMUM DEFLECTION IN BEAMS

The following formulae apply only within the elastic limit of the beam:

CENTER LOADING:

$$d = \left(\frac{1}{48}\right)\left(\frac{Wl^3}{EI}\right) = \left(\frac{1}{48}\right)\left(\frac{Wl^3}{\frac{Ebh^3}{12}}\right) = \frac{1}{4}\left(\frac{Wl^3}{Ebh^3}\right)$$

THIRD POINT LOADING:

$$d = \left(\frac{23}{1296}\right)\left(\frac{Wl^3}{EI}\right) = \left(\frac{23}{1296}\right)\left(\frac{Wl^3[12]}{Ebh^3}\right) = \left(\frac{23}{108}\right)\left(\frac{Wl^3}{Ebh^3}\right)$$

UNIFORM LOADING:

$$d = \left(\frac{5}{384}\right)\left(\frac{Wl^3}{EI}\right) = \left(\frac{5}{384}\right)\left(\frac{Wl^3[12]}{Ebh^3}\right) = \left(\frac{5}{32}\right)\left(\frac{Wl^3}{Ebh^3}\right)$$

MAXIMUM SPAN—MILL AND LAMINATED FLOORS

CENTER LOADING:

$$\frac{fI}{n} = \frac{Wl}{4} \therefore l = \frac{4f}{W}\left(\frac{I}{n}\right) = \frac{4f}{\frac{lL'}{12}}\left(\frac{bh^2}{6}\right)$$

$$l^2 = \frac{8fbh^2}{L'} \therefore l = \sqrt{\frac{8fbh^2}{L'}}$$

THIRD POINT LOADING:

$$\frac{fI}{n} = \frac{Wl}{6} \therefore l = \frac{6f}{W}\left(\frac{I}{n}\right) = \frac{6f}{\frac{lL'}{12}}\left(\frac{bh^2}{6}\right)$$

$$l^2 = \frac{12fbh^2}{L'} \therefore l = \sqrt{\frac{12fbh^2}{L'}}$$

UNIFORM LOADING:

$$\frac{fI}{n} = \frac{Wl}{8} \therefore W = \frac{8fI}{ln}$$

$$l = \frac{8f}{W}\left(\frac{I}{n}\right) = \frac{8f}{W}\left(\frac{bh^2}{6}\right) = \frac{4}{3}\frac{fbh^2}{W}$$

$$W = \frac{l}{12}L'$$

$$\therefore l = \frac{4}{3}\left(\frac{fbh^2}{\frac{l}{12}L'}\right) = \frac{16fbh^2}{lL'}$$

$$l^2 = \frac{16fbh^2}{L'} \therefore l = \sqrt{\frac{16fbh^2}{L'}}$$

DEFLECTIONS IN MILL AND LAMINATED FLOORS

CENTER LOADING:

$$d = \left(\frac{1}{48}\right)\left(\frac{Wl^3}{EI}\right) \qquad W = \frac{l}{12} L'$$

$$d = \left(\frac{1}{48}\right)\left(\frac{\frac{l}{12} L' \, l^3}{\frac{Ebh^3}{12}}\right) = \frac{1}{(48)\ (1{,}643{,}000)}\left(\frac{L' \, l^4}{bh^3}\right)$$

$$d = 0.000{,}000{,}012{,}68 \left(\frac{L' \, l^4}{bh^3}\right)$$

THIRD POINT LOADING:

$$d = \left(\frac{23}{1296}\right)\left(\frac{Wl^3}{EI}\right) \qquad W = \frac{l}{12} L'$$

$$d = \left(\frac{23}{1296}\right)\left(\frac{\frac{l}{12} L'l^3}{\frac{Ebh^3}{12}}\right) = \frac{23}{(1296)\ (1{,}643{,}000)}\left(\frac{L'l^4}{bh^3}\right)$$

$$d = 0.000{,}000{,}010{,}8 \left(\frac{L'l^4}{bh^3}\right)$$

UNIFORM LOADING:

$$d = \left(\frac{5}{384}\right)\left(\frac{Wl^3}{EI}\right) \qquad W = \frac{l}{12} L'$$

$$d = \left(\frac{5}{384}\right)\left(\frac{\frac{l}{12} L'l^3}{\frac{Ebh^3}{12}}\right) = \frac{5}{(384)\ (1{,}643{,}000)}\left(\frac{L'l^4}{bh^3}\right)$$

$$d = 0.000{,}000{,}007{,}92 \left(\frac{L'l^4}{bh^3}\right)$$

BENDING MOMENT AND SHEAR

The following bending moment and shear diagrams are shown for cantilever beams and for free end beams supported at the two ends. Various methods of loading are shown for each type of beam. The bending moment and shear diagrams are shown above and below the beams, respectively.

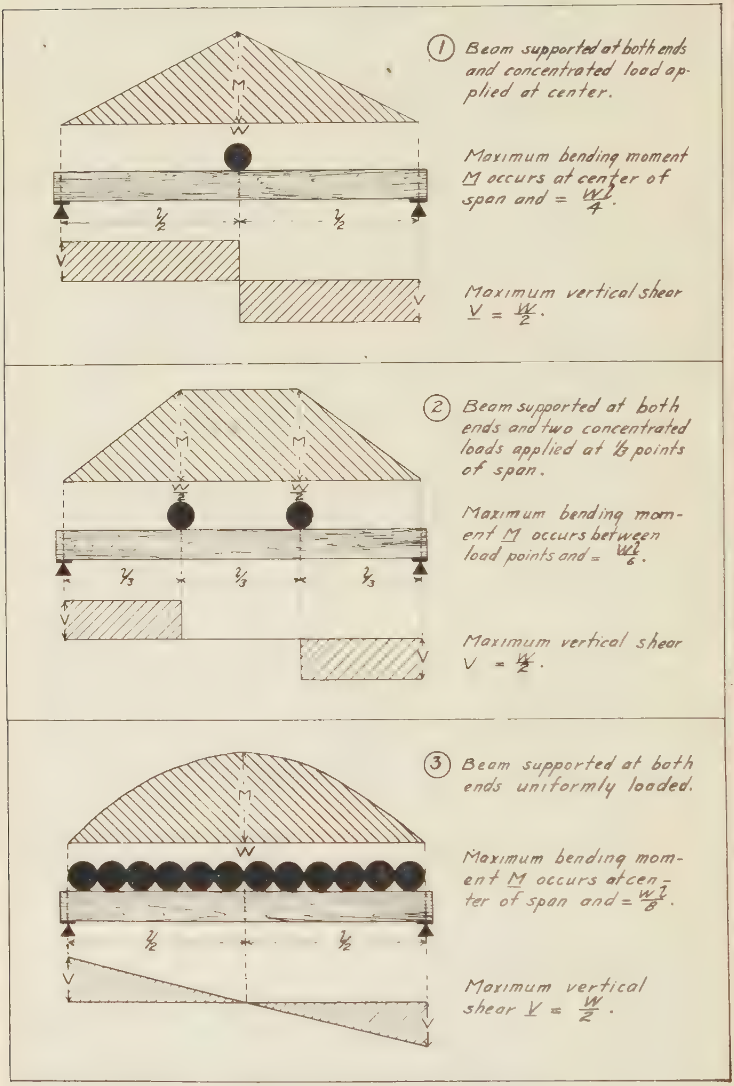


Diagram 12. Bending moment and shear diagrams.

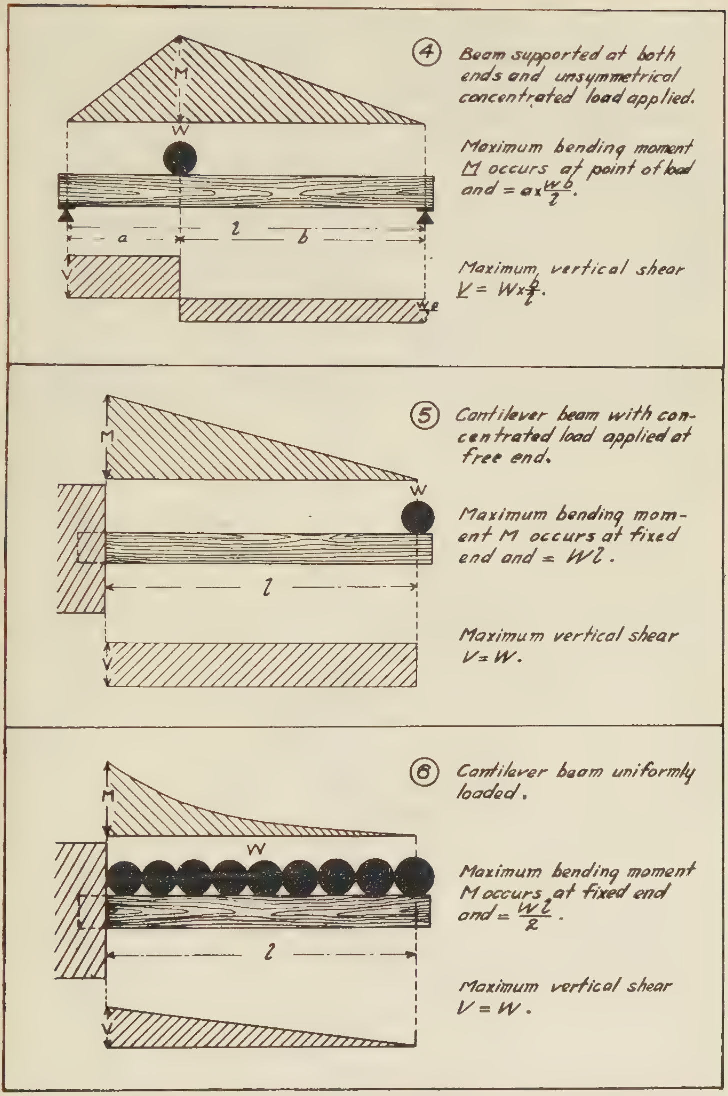


Diagram 13. Bending moment and shear diagrams.

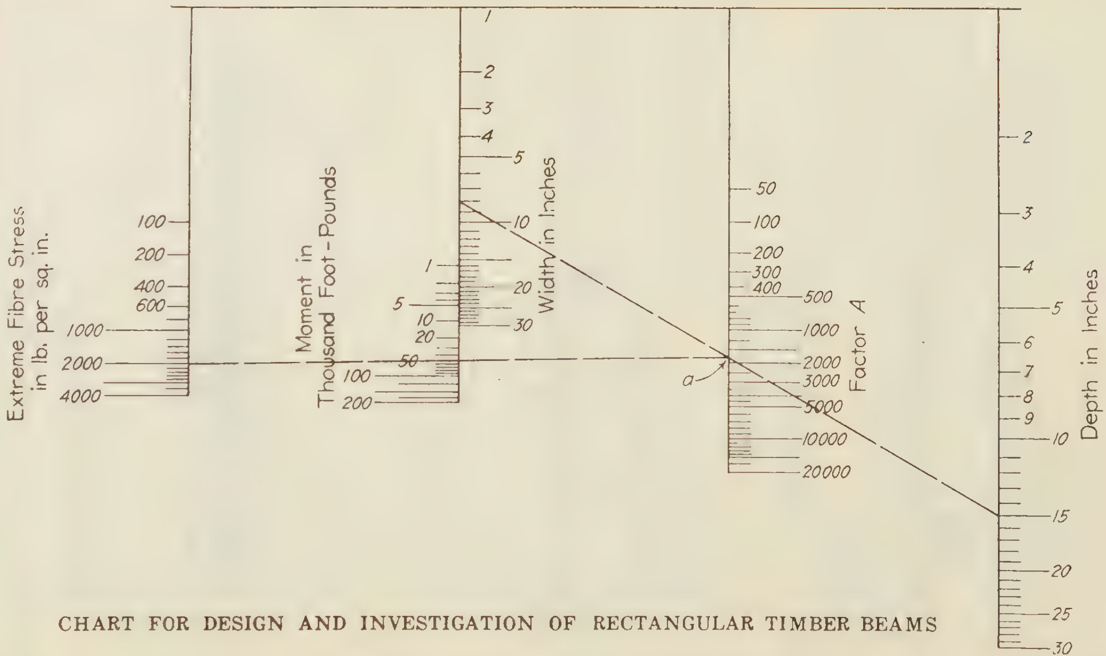


CHART FOR DESIGN AND INVESTIGATION OF RECTANGULAR TIMBER BEAMS

Fig. 7. A useful chart for tentative design.

Figure 7 is a chart taken from Engineering Record of June 26, 1915, and makes possible, rapid calculations for rectangular timber beams. Assume a working stress of 2000 pounds/sq. in. and it is desired to find a beam of sufficient size to resist a bending moment of 50,000 foot pounds. Place a straight edge on 2000 on the "Extreme Fiber Stress" scale and allow it to pass through 50 on the scale "Moment in Thousand Foot-pounds" and project to an intersection on the "Factor A" scale. Place the straight edge on this intersection point on "Factor A" scale as a pivot and read the width of beam required on the "Width in Inches" scale and the corresponding height of beam on the "Depth in Inches" scale. Any number of combinations of sizes may be selected which will fulfill the conditions assumed. The above operation may be reversed if the designer wishes to start with a definite size timber.

SAFE TOTAL LOADS AND OTHER PROPERTIES OF BEAMS

In the preparation of table 20 on beams, an effort has been made to tabulate information which will enable the designer to effect his design with minimum effort and maximum efficiency. The figures in the tables are based on beams of actual sizes surfaced S1S1E or S4S. A multiplying factor has also been computed which may be used to transfer rapidly the various loads, deflections, and other properties to the corresponding values for rough beams of full sizes as shown. These factors are written in bold face type for each size timber, and apply to figures in the same vertical column written. In this table, the area of cross section, the moment of inertia of the cross section, the section modulus, the span and the ratio of span to depth of beam are given, all for actual sizes of surfaced timbers. The safe loads and corresponding maximum deflections for uniformly distributed loads are also given, covering a range of safe fiber stresses varying from 1,000 to 2,000 pounds per square inch. The safe load, as shown, is the superimposed load, the weight of the beam having been deducted. The deflection given is that produced by the safe load shown plus the weight of the beam. The deflections are computed for beams of Douglas fir using a modulus of elasticity of 1,643,000 pounds per square inch. This value for the modulus of elasticity was determined by a careful consideration of all available data on the stiffness of Douglas fir as shown by the following tests:

Reference—	Grade	No. of Tests	Average M. of E.
U. S. Forest Service Bulletin 108, table 8	Grade I	81	1,643,000
U. S. Forest Service Bulletin 108, table 14	All Grades	134	1,611,000
U. S. Forest Service Bulletin 88, table 8	Select	59	1,654,000
City of Portland, Oregon, Bureau of Standards	Merch.	16	1,713,000
Am. Ry. Eng. Assn. Bulletin 184, table 4	Santa Fe Stand.	52	1,701,900
	Total	342	Av. 1,645,000

The above values include a large number of tests that are of an average grade below that used in general construction work and below that proposed by the West Coast Lumbermen's Association on pages 31 and 33. The only values falling below that used in this book are for those tests in which timbers of all grades were included. The remaining tests, representing average grades, show the figure for the modulus of elasticity of 1,643,000 herein used to be conservative.

There is also shown in table 20 the number of pounds supported by the actual sized beam per board foot of rough lumber. This may be termed "Efficiency Factor." This factor should be useful in determining an economical design. The higher the factor the greater is the efficiency of the beam.

In this table no loads are given which produce maximum horizontal shearing stresses of more than 185 pounds per square inch, which unitl stresses are justified as shown by the tests given on pages 18 and 19. The maximum unit horizontal shearing stresses actually produced by those loads supported on the shorter spans are given for each size beam. The values for longer spans will be lower.

The column "D," farthest to the right, shows deflections equivalent to $\frac{1}{32}$ of an inch per foot of span.

Deflections are proportional to loads, therefore, the ratio $\left(\frac{\text{Load}}{\text{Deflection}}\right)$ is constant for a given beam section and span. To find the load (W′) corresponding to any deflection, (d′), within the elastic limit and which is not shown in the tables, divide the "given load (W) plus weight of beam" by "given deflection (d)," and multiply the result by the particular deflection in question (d′), and subtract the weight of beam.

$$\frac{(\text{W} + \text{weight of beam})}{\text{d}} = \frac{(\text{W}' + \text{weight of beam})}{\text{d}'} = \text{Constant}$$

therefore $\text{W}' = \left[\frac{(\text{W} + \text{weight of beam})}{\text{d}}\right]\text{d}' - (\text{weight of beam}).$

Usually in practice the weight of the beam in the above computation may be neglected, which will simplify the operation to dividing the given load by the given deflection and multiplying the result by the particular deflection to secure the new load.

For safe loads on beams in which a concentrated load is applied at the center of the span, multiply the load given in the table by 0.50. For safe loads on beams in which equal concentrated loads are applied at the third points of the span, multiply the given load by 0.75.

For deflections in beams in which a concentrated load equal to one-half that shown in the table is applied at the center of the span, multiply the deflection given in the table by 0.802. For deflections in beams in which equal concentrated loads totaling three-fourths that shown in the table, are applied at the third points of the span, multiply the given deflection by 1.025.

TABLE OF SAFE LOADS AND DEFLECTIONS FOR DOUGLAS FIR BEAMS SUPPORTED AT BOTH ENDS AND UNIFORMLY LOADED

Values in this table are based on surfaced sizes. To get values for rough sizes multiply factor by number in **bold face type** in same vertical column for any given size.

Ref. No. 1.—Total Safe Superimposed Load, Pounds.
Ref. No. 2.—Maximum Deflection, Inches.
Ref. No. 3.—Pounds supported per Board Foot.
Ref. No. 4.—Maximum Horizontal Shearing Stress developed.

Maximum Horizontal Shear allowed, 185 Pounds per Square Inch. Modulus of Elasticity used, 1,643,000 Pounds per Square Inch.

TABLE 20

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
								1	787	866	945	1025	1104	1183	1262	1421	......	
						3	9.9	2	0.0454	0.0499	0.0545	0.0590	0.0636	0.0681	0.0726	0.0817	......	0.0938
								3	394	433	473	513	552	592	631	711	......	
								4	101	111	121	131	141	151	161	182	......	
								1	588	647	707	766	826	885	944	1063	1182	
						4	13.2	2	0.0808	0.0888	0.0969	0.105	0.113	0.121	0.129	0.145	0.161	0.125
2x4	1⅝x3⅝	5.89	6.45	3.56	1.554			3	220	243	265	287	310	332	354	399	443	
		1.359	**1.654**	**1.498**	**1.359**			4	......	......	......	......	......	......	......	......	151	
								1	467	515	562	610	657	705	752	847	942	
						5	16.6	2	0.126	0.139	0.151	0.164	0.176	0.189	0.202	0.227	0.252	0.156
								3	140	155	169	183	197	212	226	254	283	
								1	387	427	466	506	545	585	625	704	783	
						6	19.9	2	0.182	0.200	0.218	0.236	0.254	0.272	0.290	0.327	0.363	0.188
								3	97	107	117	127	136	146	156	176	196	

						7	23.2	1	328	362	396	430	464	498	531	599	667	0.219
								2	0.247	0.272	0.296	0.321	0.346	0.370	0.395	0.444	0.494	
								3	70	78	85	92	99	107	114	128	143	
						Multiplying Factor		1	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	
								2	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0 91	0.91	
								4	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
						4	8.5	1	1419	1562	1705	1848	1991	2134	......	......	......	0.125
								2	0.0520	0.0572	0.0624	0.0676	0.0728	0.0780	......	......	......	
								3	355	391	426	462	498	534	......	......	......	
								4	117	129	140	152	164	176	......	......	......	
						5	10.7	1	1131	1245	1360	1474	1588	1703	1817	2045	......	0.156
								2	0.0812	0.0893	0.0974	0.106	0.114	0.122	0.130	0.146	......	
								3	226	249	272	295	318	341	363	409	......	
								4	......	......	......	......	......	......	150	169	......	
						6	12.8	1	939	1034	1130	1225	1320	1416	1511	1701	1892	0.188
								2	0.1170	0.129	0.140	0.152	0.164	0.176	0.187	0.211	0.234	
								3	157	172	188	204	220	236	252	284	315	
								4	......	......	......	......	......	......	......	......	156	
						7	14.9	1	799	881	962	1044	1125	1207	1289	1452	1615	0.219
2x6	1⅝x5⅝	9.14	24.10	8.57	2.411			2	0.159	0.175	0.191	0.207	0.223	0.239	0.255	0.287	0.318	
		1.313	1.494	1.400	1.313			3	114	126	137	149	161	172	184	207	231	
						8	17.1	1	695	766	838	909	981	1052	1123	1266	1409	0.250
								2	0.208	0.229	0.250	0.270	0.291	0.312	0.333	0.374	0.416	
								3	87	96	105	114	123	132	140	158	176	
						9	19.2	1	613	677	740	804	867	931	994	1121	1248	0.281
								2	0.263	0.289	0.316	0 342	0.368	0.395	0.421	0.474	0.526	
								3	68	75	82	89	96	103	110	125	139	
						10	21.3	1	547	604	661	718	775	833	890	1004	1118	0.313
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650	
								3	55	60	66	72	78	83	89	100	112	
						11	23.5	1	492	544	596	648	700	752	803	907	1011	0.344
								2	0.393	0.432	0.471	0.511	0.550	0.589	0.628	0.707	0.785	
								3	45	49	54	59	64	68	73	82	92	
						Multiplying Factor		1	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	
								2	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
								4	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						5	8.0	1	2014	2217	2420	2623	2826	......	......	......	......	0.156
								2	0.0608	0.0669	0.0730	0.0791	0.0852	......	......	......	......	
								3	302	332	363	393	424	......	......	......	......	
								4	125	137	150	162	175	......	......	......	......	
						6	9.6	1	1673	1842	2011	2181	2350	2519	2688	......	......	0.188
								2	0.0876	0.0963	0.105	0.114	0.123	0.131	0.140	......	......	
								3	209	230	251	273	294	315	336	......	......	
								4	......	......	......	......	......	156	167	......	......	
2x8	1⅝x7½	12.19	57.13	15.23	3.216	7	11.2	1	1427	1572	1717	1862	2007	2152	2297	2587	2877	0.219
								2	0.119	0.131	0.143	0.155	0.167	0.179	0.191	0.215	0.238	
								3	153	168	184	200	215	231	246	277	308	
		1.313	**1.494**	**1.400**	**1.313**			4	......	......	......	......	......	......	......	161	178	
						8	12.8	1	1243	1370	1497	1624	1751	1878	2004	2258	2512	0.250
								2	0.156	0.171	0.187	0.202	0.218	0.234	0.249	0.280	0.311	
								3	117	128	140	152	164	176	188	212	236	
						9	14.4	1	1099	1212	1325	1437	1550	1663	1776	2001	2227	0.281
								2	0.197	0.217	0.237	0.256	0.276	0.296	0.316	0.355	0.394	
								3	92	101	110	120	129	139	148	167	186	
						10	16.0	1	983	1085	1186	1288	1389	1491	1592	1795	1998	0.313
								2	0.243	0.267	0.292	0.316	0.340	0.365	0.389	0.438	0.486	
								3	74	81	89	97	104	112	119	135	150	

2x8	$1\frac{5}{8}$x$7\frac{1}{2}$	12.19 **1.313**	57.13 **1.494**	15.23 **1.400**	3.216 **1.313**	11	17.6	1 2 3	888 0.294 61	980 0.324 67	1073 0.353 73	1165 0.383 79	1257 0.412 86	1350 0.442 92	1442 0.471 98	1626 0.530 111	1811 0.589 123	0.344
						12	19.2	1 2 3	807 0.350 50	892 0.385 56	976 0.420 61	1061 0.455 66	1145 0.490 72	1230 0.526 77	1315 0.561 82	1484 0.631 93	1653 0.701 103	0.375
						13	20.8	1 2 3	739 0.411 43	817 0.452 47	895 0.493 52	973 0.534 56	1051 0.576 61	1130 0.617 65	1208 0.658 70	1364 0.740 79	1520 0.822 88	0.406
						14	22.4	1 2 3	680 0.477 36	753 0.525 40	825 0.572 44	898 0.620 48	970 0.668 52	1043 0.716 56	1115 0.763 60	1260 0.858 68	1405 0.954 75	0.438
						15	24.0	1 2 3	629 0.548 31	697 0.602 35	764 0.657 38	832 0.712 42	900 0.767 45	968 0.822 48	1035 0.876 52	1171 0.986 59	....	0.469
						Multiplying Factor		1 2 4	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	**1.40** **0.94** **1.06**	
2x10	$1\frac{5}{8}$x$9\frac{1}{2}$	15.44 **1.295**	116.10 **1.435**	24.44 **1.364**	4.073 **1.295**	7	8.8	1 2 3 4	2300 0.0942 197 113	2533 0.104 217 125	2766 0.113 237 136	2999 0.123 257 147	3232 0.132 277 159	3465 0.141 297 170	3697 0.151 317 181	....	....	0.219
						8	10.1	1 2 3 4	2005 0.123 150	2209 0.135 166	2413 0.148 181	2616 0.160 196	2820 0.172 212	3024 0.185 227	3228 0.197 242	3635 0.222 273 178	....	0.250
						9	11.4	1 2 3 4	1774 0.156 118	1955 0.171 130	2136 0.187 142	2317 0.203 154	2498 0.218 167	2680 0.234 179	2861 0.249 191	3223 0.281 215	3585 0.312 239 176	0.281
						10	12.6	1 2 3	1589 0.192 95	1752 0.212 105	1915 0.231 115	2078 0.250 125	2241 0.269 134	2404 0.289 144	2567 0.308 154	2893 0.346 174	3219 0.385 193	0.313

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
						11	13.9	1	1437	1585	1733	1882	2030	2178	2326	2623	2919	0.344
								2	0.233	0.256	0.279	0.302	0.326	0.349	0.372	0.419	0.465	
								3	78	86	95	103	111	119	127	143	159	
						12	15.2	1	1310	1446	1582	1718	1854	1990	2125	2397	2669	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	65	72	79	86	93	100	106	120	133	
						13	16.4	1	1201	1326	1452	1577	1703	1828	1953	2204	2455	0.406
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650	
2x10	1⅝x9½	15.44	116.10	24.44	4.073			3	55	61	67	73	79	84	90	102	113	
		1.295	1.435	1.364	1.295	14	17.7	1	1107	1223	1340	1456	1573	1689	1805	2038	2271	0.438
								2	0.377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754	
								3	47	52	57	62	67	72	77	87	97	
						15	19.0	1	1026	1135	1243	1352	1461	1570	1678	1896	2113	0.469
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866	
								3	41	45	50	54	58	63	67	76	85	
						16	20.2	1	954	1056	1158	1260	1362	1464	1565	1769	1973	0.500
								2	0.492	0.542	0.591	0.640	0.689	0.738	0.788	0.886	0.985	
								3	36	40	43	47	51	55	59	66	74	
						17	21.5	1	890	986	1082	1178	1274	1370	1465	......	......	0.531
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......	
								3	31	35	38	42	45	48	52	......	......	

						18	22.7	1	833	924	1014	1105	1195	1286	1377	......	......	0.563
								2	0.623	0.686	0.748	0.810	0.873	0.935	0.997	......	......	
								3	28	31	34	37	40	43	46	......	......	
						19	24.0	1	781	867	953	1038	1124	......	......	......	......	0.594
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......	
								3	25	27	30	33	36	......	......	......	......	
						Multiplying Factor		1	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	
								2	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	
								4	**1.05**	**1.05**	**1.05**	**1 05**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**	
						8	8.3	1	2947	3246	3544	3843	4141	4440	......	......	......	0.250
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......	
								3	184	203	222	240	259	278	......	......	......	
								4	120	132	144	156	168	180	......	......	......	
						9	9.4	1	2610	2875	3141	3406	3672	3937	4202	......	......	0.281
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......	
								3	145	160	175	189	204	219	233	......	......	
								4	......	......	......	......	......	......	170	......	......	
						10	10.4	1	2340	2579	2818	3057	3296	3535	3773	4251	......	0.313
								2	0.159	0.175	0.191	0.207	0.222	0.238	0.254	0.286	......	
2x12	$1\frac{5}{8}$x$11\frac{1}{2}$	18.69	205.95	35.82	4.931			3	117	129	141	153	165	177	189	213	......	
		1.285	**1.399**	**1.340**	**1.285**			4	......	......	......	......	......	......	......	173	......	
						11	11.5	1	2117	2334	2551	2768	2985	3203	3420	3854	4288	0.344
								2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0.346	0.384	
								3	96	106	116	126	136	146	155	175	195	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	1932	2131	2330	2529	2728	2928	3127	3525	3923	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	81	89	97	105	114	122	130	147	164	
						13	13.6	1	1773	1957	2140	2324	2508	2692	2875	3243	3610	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	68	75	82	89	96	104	111	125	139	
						14	14.6	1	1637	1808	1978	2149	2319	2490	2661	3002	3343	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0.498	0.561	0.623	
								3	58	65	71	77	83	89	95	107	119	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
								1	1519	1678	1838	1997	2156	2316	2475	2793	3112	
						15	15.7	2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	0.469
								3	51	56	61	67	72	77	83	93	104	
								1	1414	1563	1713	1862	2011	2161	2310	2608	2907	
						16	16 7	2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	0.500
								3	44	49	54	58	63	68	72	82	91	
								1	1321	1462	1602	1743	1883	2024	2164	2445	2726	
						17	17.7	2	0.459	0.505	0 551	0.597	0.643	0.688	0.734	0.826	0.918	0.531
								3	39	43	47	51	55	60	64	72	80	
2x12	1⅝x11½	18.69	205.95	35.82	4.931			1	1238	1371	1503	1636	1769	1902	2034	2300	......	
						18	18.8	2	0.515	0 566	0.618	0.670	0.721	0.773	0.824	0.927	......	0.563
		1.285	1.399	1.340	1.285			3	34	38	42	45	49	53	57	64	......	
								1	1163	1289	1414	1540	1666	1792	1917	......	......	
						19	19 8	2	0.573	0.631	0.688	0.745	0.802	0.860	0.917	......	......	0.594
								3	31	34	37	41	44	47	50	......	......	
								1	1095	1214	1334	1453	1573	1692	......	......	......	
						20	20 9	2	0.635	0.699	0 762	0.826	0.889	0.953	......	......	......	0.625
								3	27	30	33	36	39	42	......	......	......	
								1	1033	1147	1260	1374	1488	......	......	......	......	
						21	21 9	2	0 701	0 771	0 841	0 911	0.981	......	......	......	......	0.656
								3	25	27	30	33	35	...	...	......	......	

						22	23.0	1	978	1087	1195	1304	......	......	......	......	......
								2	0.769	0.846	0.923	1.000	......	......	......	......	......
								3	22	25	27	30	......	......	......	......	......
																	0.688
						23	24.0	1	926	1030	......	......	......	......	......	......	......
								2	0.841	0.925	......	......	......	......	......	......	......
								3	20	22	......	......	......	......	......	......	......
																	0.719
						Multiplying Factor		1	1.34	1.34	1.34	1 34	1.34	1.34	1 34	1.34	1.34	
								2	0.95	0.95	0 95	0 95	0 95	0.95	0 95	0 95	0 95	
								4	1.04	1 04	1.04	1.04	1 04	1.04	1 04	1 04	1.04	
						9	8.0	1	3604	3970	4335	4701	5066	......	......	......	......	0.281
								2	0.110	0.121	0.131	0.142	0.153	......	......	......	......	
								3	172	189	206	224	241	......	......	......	......	
								4	125	138	150	163	175	......	......	......	......	
						10	8.9	1	3232	3561	3890	4219	4548	4877	5206	......	......	0.313
								2	0.135	0.149	0.162	0.176	0.189	0.203	0.216	......	......	
								3	139	153	167	181	195	209	223	......	......	
								4	......	......	......	......	......	169	180	......	......	
						11	9.8	1	2927	3226	3525	3824	4123	4423	4722	5320	......	0.344
								2	0.164	0.180	0.196	0.213	0.229	0.245	0.262	0.295	......	
2x14	1⅝x13½	21.94	333.18	49.36	5.788			3	114	126	137	149	161	172	184	207	......	
		1.276	1.372	1.324	1.276			4	......	......	......	......	......	......	......	184	......	
						12	10.7	1	2671	2945	3219	3493	3767	4042	4316	4864	......	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0.311	0.350	......	
								3	95	105	115	125	135	144	154	174	......	
						13	11.6	1	2456	2709	2962	3215	3468	3722	3975	4481	4987	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0.457	
								3	81	89	98	106	114	123	131	148	164	
								4	......	......	......	......	......	......	......	......	173	
						14	12.4	1	2269	2504	2739	2974	3209	3444	3679	4149	4619	0.438
								2	0.265	0.292	0.318	0.344	0.371	0.397	0.424	0.477	0.530	
								3	69	77	84	91	98	105	113	127	141	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
								1	2106	2325	2545	2764	2983	3203	3422	3860	4299	
						15	13.3	2	0.304	0.334	0.365	0.395	0.426	0.456	0.486	0.547	0.608	0.469
								3	60	66	73	79	85	92	98	110	123	
								1	1963	2169	2374	2580	2785	2991	3197	3608	4019	
						16	14.2	2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0.692	0.500
								3	53	58	64	69	75	80	86	97	108	
								1	1837	2031	2224	2418	2611	2805	2998	3385	3772	
						17	15.1	2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	0.531
2x14	1⅝x13½	21.94	333.18	49.36	5.788			3	46	51	56	61	66	71	76	85	95	
		1.276	1.372	1.324	1.276			1	1723	1906	2088	2271	2454	2637	2819	3185	3550	
						18	16.0	2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	0.563
								3	41	45	50	54	58	63	67	76	85	
								1	1622	1795	1968	2142	2315	2488	2661	3008	3354	
						19	16.9	2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	0.594
								3	37	41	44	48	52	56	60	68	76	
								1	1529	1694	1858	2023	2187	2352	2516	2845	......	
						20	17.8	2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	......	0.625
								3	33	36	40	43	47	50	54	61	......	
								1	1445	1602	1758	1915	2072	2229	2385	......	......	
						21	18.7	2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	0.656
								3	29	33	36	39	42	45	49	......	......	

The column group 1000–2000 is headed: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

2x14	$1\frac{5}{8}$x$13\frac{1}{2}$	21.94	333.18	49.36	5.788	22	19.6	1	1368	1518	1667	1817	1966	2116	......	......	......	0.688
		1.276	**1.372**	**1.324**	**1.276**			2	0.654	0.719	0.785	0.850	0.915	0.981	......	......	......	
								3	27	30	32	35	38	41	......	......	......	
						23	20.4	1	1298	1441	1584	1727	......	......	......	......	......	0.719
								2	0.715	0.787	0.858	0.930	......	......	......	......	......	
								3	24	27	30	32	......	......	......	......	......	
						24	21.3	1	1232	1369	1506	......	......	......	......	......	......	0.750
								2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	22	24	27	......	......	......	......	......	......	
						25	22.2	1	1171	1303	......	......	......	......	......	......	......	0.781
								2	0.844	0.929	......	......	......	......	......	......	......	
								3	20	22	......	......	......	......	......	......	......	
						26	23.1	1	1115	......	......	......	......	......	......	......	......	0.813
								2	0.914	......	......	......	......	......	......	......	......	
								3	18	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	
								2	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	
								4	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**	
2x16	$1\frac{5}{8}$x$15\frac{1}{2}$	25.19	504.28	65.07	6.648	11	8.5	1	3871	4265	4660	5054	5449	5843	......	......	......	0.344
		1.271	**1.353**	**1.311**	**1.271**			2	0.143	0.157	0.171	0.185	0.200	0.214	......	......	......	
								3	132	145	159	172	186	199	......	......	......	
								4	117	129	141	153	164	176	......	......	......	
						12	9.3	1	3537	3899	4260	4622	4984	5346	5707	......	......	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	......	......	
								3	111	122	133	144	156	167	178	......	......	
								4	......	......	......	......	......	......	172	......	......	
						13	10.1	1	3253	3587	3921	4255	4589	4923	5256	5924	......	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	......	
								3	94	103	113	123	132	142	152	171	......	
								4	......	......	......	......	......	......	......	179	......	
						14	10.8	1	3007	3317	3627	3937	4247	4557	4867	5487	6107	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	81	89	97	105	114	122	130	147	164	
								4	......	......	......	......	......	......	......	......	185	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A = bh$	Moment of Inertia $I = \frac{bh^3}{12}$	Section Modulus $S = \frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
									Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									
In.	In.	Sq. In.	$In.^4$	$In.^3$	Lbs.	Ft.												In.
						15	11.6	1	2792	3081	3370	3660	3949	4238	4527	5106	5684	0.469
								2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	
								3	70	77	84	91	99	106	113	128	142	
						16	12.4	1	2605	2876	3147	3418	3689	3961	4232	4774	5316	0.500
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	
								3	61	67	74	80	86	93	99	112	125	
2x16	1⅝x15½	25.19	504.28	65.07	6.648	17	13.2	1	2439	2694	2949	3205	3460	3715	3970	4481	4991	0.531
		1 271	1.353	1.311	1.271			2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	54	59	65	71	76	82	88	99	110	
						18	13.9	1	2290	2531	2772	3013	3254	3495	3736	4218	4700	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	48	53	58	63	68	73	78	88	98	
						19	14.7	1	2157	2385	2614	2842	3070	3299	3527	3983	4440	0.594
								2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	43	47	52	56	61	65	70	79	88	
						20	15.5	1	2037	2254	2471	2688	2905	3122	3339	3773	4207	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	38	42	46	50	54	59	63	71	79	
						21	16.3	1	1927	2134	2340	2547	2754	2961	3167	3581	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	34	38	42	45	49	53	57	64	..	

						22	17.0	1	1826	2023	2220	2418	2615	2812	3009	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	31	34	38	41	45	48	51	......	......	
						23	17.8	1	1733	1922	2110	2299	2487	2676	2865	......	......	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	......	......	
								3	28	31	34	38	41	44	47	......	......	
						24	18.6	1	1648	1829	2010	2190	2371	......	......	......	......	0.750
								2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	26	29	31	34	37	......	......	......	......	
						25	19.4	1	1570	1744	1917	2091	......	......	......	......	......	0.781
2x16	1⅝x15½	25.19	504.28	65.07	6.648			2	0.737	0.811	0.884	0.958	......	......	......	......	......	
								3	24	26	29	31	......	......	......	......	......	
		1.271	1.353	1.311	1.271	26	20.1	1	1496	1663	1830	......	......	......	......	......	......	0.813
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	22	24	26	......	......	......	......	......	......	
						27	20.7	1	1427	1588	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	20	22	......	......	......	......	......	......	......	
						28	21 7	1	1364	......	......	......	......	......	......	......	......	0.875
								2	0.923	......	......	......	......	......	......	......	......	
								3	18	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						12	8.2	1	4518	4979	5440	5900	6361	6822	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	125	138	151	164	177	190	......	......	......	
2x18	1⅝x17½	28.44	725.75	82.94	7.505			4	122	134	146	158	170	182	......	......	......	
		1.265	1.340	1.303	1.265	13	8.9	1	4154	4579	5004	5430	5855	6280	6705	......	......	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	106	117	128	139	150	161	172	......	......	
								4	......	......	......	......	......	......	180	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
2x18	$1\frac{5}{8}$x$17\frac{1}{2}$	28.44	725.75	82.94	7.505	14	9.6	1	3845	4240	4635	5030	5425	5820	6215	......	......	0.438
		1.265	1.340	1.303	1.265			2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
								3	92	101	110	120	129	139	148	......	......	
						15	10.3	1	3573	3942	4310	4679	5047	5416	5785	6522	......	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	......	
								3	79	88	96	104	112	120	129	145	......	
								4	......	......	......	......	......	......	......	175	......	
						16	11.0	1	3335	3681	4026	4372	4717	5063	5408	6099	6790	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	69	77	84	91	98	106	113	127	141	
								4	......	......	......	......	......	......	......	......	182	
						17	11.7	1	3123	3448	3773	4098	4423	4749	5074	5724	6374	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	61	68	74	80	87	93	100	112	125	
						18	12.3	1	2936	3243	3550	3857	4164	4472	4779	5393	6007	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	54	60	66	71	77	83	89	100	111	
						19	13.0	1	2767	3058	3349	3640	3931	4222	4513	5095	5677	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	49	54	59	64	69	74	79	89	100	
						20	13.7	1	2614	2890	3167	3443	3720	3996	4272	4825	5378	0.625
								2	0.417	0.459	0.501	.543	0.584	0.626	0.668	0.751	0.834	
								3	44	48	53	57	62	67	71	80	90	

2x18	1⅝x17½	28.44	725.75	82.94	7.505	21	14.4	1	2474	2737	3000	3264	3527	3790	4053	4580	5106	0.656
		1.265	1.340	1.303	1.265			2	0.460	0.506	0.552	0.598	0 644	0.690	0.736	0.828	0.920	
								3	39	43	48	52	56	60	64	73	81	
						22	15.1	1	2347	2598	2849	3101	3352	3603	3854	4357	......	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	......	
								3	36	39	43	47	51	55	58	66	......	
						23	15.8	1	2231	2471	2712	2952	3193	3433	3673	4154	......	0.719
								2	0.552	0 608	0.663	0.718	0.773	0.829	0.884	0.994	......	
								3	32	36	39	43	46	50	53	60	......	
						24	16.5	1	2122	2352	2582	2813	3043	3273	3503	......	......	0.750
								2	0.601	0.661	0.721	0.781	0 841	0.901	0.961	......	......	
								3	29	33	36	39	42	45	49	......	......	
						25	17.1	1	2023	2244	2465	2686	2907	3129	......	......	......	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	......	......	......	
								3	27	30	33	36	39	42	......	......	......	
						26	17.8	1	1932	2145	2357	2570	2783	......	......	......	......	0.813
								2	0.705	0.775	0.846	0.917	0.987	......	......	......	......	
								3	25	28	30	33	36	......	......	......	......	
						27	18.5	1	1845	2050	2255	2459	......	......	......	......	......	0.844
								2	0.761	0.837	0.913	0.989	......	......	......	......	......	
								3	23	25	28	30	......	......	......	......	......	
						28	19.2	1	1765	1963	2160	......	......	......	......	......	......	0.875
								2	0.818	0.900	0.982	......	......	......	......	......	......	
								3	21	23	26	......	......	......	......	......	......	
						29	19.9	1	1688	1879	......	......	......	......	......	......	......	0.906
								2	0.877	0.965	......	......	......	......	......	......	......	
								3	19	22	......	......	......	......	......	......	......	
						30	20.6	1	1618	......	......	......	......	......	......	......	......	0.938
								2	0.939	......	......	......	......	......	......	......	......	
								3	18	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	
								2	0.97	0.97	0.97	0.97	0 97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1 03	1.03	1.03	1 03	1 03	1.03	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						4	8.7	1	2085	2295	2505	2715	2925	3135	3345	......	......	0.125
								2	0.0532	0.0585	0.0638	0.0691	0.0744	0.0797	0.0850	......	......	
								3	348	383	418	453	488	523	558	......	......	
								4	115	126	137	149	160	172	183	......	......	
						5	10.9	1	1662	1830	1998	2166	2334	2502	2670	3006	3342	0.156
								2	0.0830	0.0913	0.0996	0.108	0.116	0.125	0.133	0.149	0.166	
								3	222	244	267	289	311	334	356	401	446	
								4	......	......	......	......	......	......	......	165	183	
3x6	2½x5½	13.75	34.66	12.60	3.630	6	13.1	1	1378	1518	1658	1798	1938	2078	2218	2498	2778	0.188
		1.309	**1.558**	**1.428**	**1.309**			2	0.120	0.132	0.144	0.155	0.167	0.179	0.191	0.215	0.239	
								3	153	168	184	200	215	231	247	278	309	
						7	15.3	1	1175	1295	1415	1535	1655	1775	1895	2135	2375	0.219
								2	0.163	0.179	0.195	0.212	0.228	0.244	0.261	0.293	0.326	
								3	112	123	135	146	158	169	180	203	226	
						8	17.5	1	1021	1126	1231	1336	1441	1546	1651	1861	2071	0.250
								2	0.213	0.234	0.255	0.276	0.298	0.319	0.340	0.383	0.425	
								3	85	94	103	111	120	129	138	155	173	
						9	19.6	1	901	994	1088	1181	1275	1368	1461	1648	1835	0.281
								2	0.269	0.296	0.323	0.350	0.377	0.404	0.431	0.485	0.539	
								3	67	74	81	88	94	101	108	122	136	

						10	21.8	1	804	888	972	1056	1140	1224	1308	1476	1644
								2	0.332	0.365	0.398	0.432	0.465	0.498	0.531	0.597	0.664
								3	54	59	65	70	76	82	87	98	110
																	0.313
						11	24.0	1	724	800	877	953	1030	1106	1182	1335	1488
								2	0.402	0.442	0.482	0.522	0.563	0.603	0.643	0.723	0.804
								3	44	48	53	58	62	67	72	81	90
																	0.344
						Multiplying Factor		1	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**	**1.43**
								2	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**
								4	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**
						5	8.0	1	3098	3410	3723	4035	4347	......	......	......	......
								2	0.0608	0.0669	0.0730	0.0791	0.0852	......	......	......	......
								3	310	341	372	404	435	......	......	......	......
								4	125	137	150	162	175	......	......	......	......
																	0.156
						6	9.6	1	2573	2833	3094	3354	3614	3875	4135	......	......
								2	0.0876	0.0963	0.105	0.114	0.123	0.131	0.140	......	......
								3	214	236	258	280	301	323	344	......	......
								4	......	......	......	......	......	156	167	......	......
																	0.188
						7	11.2	1	2196	2419	2642	2865	3088	3312	3535	3981	4427
								2	0.119	0.131	0.143	0.155	0.167	0.179	0.191	0.215	0.238
3x8	2½x7½	18.75	87.89	23.42	4.947			3	157	173	189	205	221	237	253	284	316
		1.280	**1.456**	**1.366**	**1.280**			4	......	......	......	......	......	......	......	161	178
																	0.219
						8	12.8	1	1912	2107	2302	2498	2693	2888	3083	3474	3864
								2	0.156	0.171	0.187	0.202	0.218	0.234	0.249	0.280	0.311
								3	120	132	144	156	168	180	193	217	242
																	0.250
						9	14.4	1	1690	1864	2037	2211	2384	2558	2731	3078	3425
								2	0.197	0.217	0.237	0.256	0.276	0.296	0.316	0.355	0.394
								3	94	104	113	123	133	142	152	171	190
																	0.281
						10	16.0	1	1513	1669	1825	1982	2138	2294	2450	2763	3075
								2	0.243	0.267	0.292	0.316	0.340	0.365	0.389	0.438	0.486
								3	76	83	91	99	107	115	123	138	154
																	0.313
						11	17.6	1	1366	1508	1650	1792	1934	2076	2218	2502	2786
								2	0.294	0.324	0.353	0.383	0.412	0.442	0.471	0.530	0.589
								3	62	69	75	81	88	94	101	114	127
																	0.344

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu.ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						12	19.2	1	1242	1372	1502	1632	1762	1893	2023	2283	2543	0.375
								2	0.350	0.385	0.420	0.455	0.490	0.526	0.561	0.631	0.701	
								3	52	57	63	68	73	79	84	95	106	
						13	20.8	1	1137	1257	1377	1497	1617	1738	1858	2098	2338	0.406
								2	0.411	0.452	0.493	0.534	0.576	0.617	0.658	0.740	0.822	
								3	44	48	53	58	62	67	71	81	90	
3x8	2½x7½	18.75	87.89	23.42	4.947	14	22.4	1	1047	1159	1270	1382	1493	1605	1717	1940	2163	0.438
		1.280	1.456	1.366	1.280			2	0.477	0.525	0.572	0.620	0.668	0.716	0.763	0.858	0.954	
								3	37	41	45	49	53	57	61	69	77	
						15	24.0	1	967	1071	1175	1279	1383	1488	1592	1800	......	0.469
								2	0.548	0.602	0.657	0.712	0.767	0.822	0.876	0.986	......	
								3	32	36	39	43	46	50	53	60	......	
						Multiplying Factor		1	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	
								2	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
								4	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
						7	8.8	1	3537	3895	4253	4611	4969	5328	5686	......	......	0.219
								2	0.0942	0.104	0.113	0.123	0.132	0.141	0.151	......	......	
								3	202	223	243	264	284	305	325	......	......	
								4	113	125	136	147	159	170	181	......	......	

3x10	2½x9½	23.75	178.62	37.61	6 270	8	10.1	1	3084	3397	3711	4024	4338	4651	4964	5591	......	0.250
		1.263	1 400	1 330	1.263			2	0.123	0.135	0.148	0.160	0 172	0 185	0 197	0.222	......	
								3	154	170	186	201	217	233	248	280	......	
								4	......	......	......	......	......	......	......	178	......	
						9	11.4	1	2731	3010	3288	3567	3846	4125	4403	4961	5518	0.281
								2	0.156	0.171	0.187	0 203	0.218	0 234	0.249	0.281	0 312	
								3	121	134	146	158	171	183	196	220	245	
								4	......	......	......	......	......	......	......	......	176	
						10	12.6	1	2445	2696	2947	3197	3448	3699	3950	4451	4953	0.313
								2	0.192	0.212	0.231	0.250	0.269	0.289	0.308	0.346	0.385	
								3	98	108	118	128	138	148	158	178	198	
						11	13.9	1	2211	2439	2667	2895	3123	3351	3579	4035	4491	0 344
								2	0.233	0.256	0.279	0.302	0.326	0.349	0 372	0.419	0.465	
								3	80	89	97	105	114	122	130	147	163	
						12	15.2	1	2014	2223	2432	2641	2850	3059	3267	3685	4103	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	67	74	81	88	95	102	109	123	137	
						13	16.4	1	1847	2040	2233	2426	2619	2812	3004	3390	3776	0.406
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650	
								3	57	63	69	75	81	87	92	104	116	
						14	17.7	1	1703	1882	2061	2240	2419	2599	2778	3136	3494	0.438
								2	0.377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754	
								3	49	54	59	64	69	74	79	90	100	
						15	19.0	1	1577	1744	1911	2078	2245	2413	2580	2914	3248	0.469
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866	
								3	42	47	51	55	60	64	69	78	87	
						16	20.2	1	1467	1624	1780	1937	2094	2251	2407	2721	3034	0.500
								2	0.492	0.542	0.591	0.640	0.689	0.738	0.788	0.886	0.985	
								3	37	41	45	48	52	56	60	68	76	
						17	21.5	1	1368	1516	1663	1811	1958	2106	2253	......	......	0.531
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......	
								3	32	36	39	43	46	50	53	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						18	22.7	1	1280	1419	1559	1698	1837	1977	2116	......	......	0.563
								2	0.623	0.686	0.748	0.810	0.873	0.935	0.997	......	......	
								3	28	32	35	38	41	44	47	...	...	
3x10	2½x9½	23.75	178.62	37.61	6.270	19	24.0	1	1201	1333	1465	1597	1729	......	......	......	......	0.594
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......	
		1.263	1.400	1.330	1.263			3	25	28	31	34	36	......	......	......	......	
						Multiplying Factor		1	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
						8	8.3	1	4530	4989	5448	5907	6366	6826	......	......	......	0.250
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......	
								3	189	208	227	246	265	284	......	......	......	
								4	120	132	144	156	168	180	......	......	......	
3x12	2½x11½	28.75	316.85	55.10	7.590	9	9.4	1	4014	4422	4830	5239	5647	6055	6463	......	......	0.281
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......	
		1.252	1.364	1.306	1.252			3	149	164	179	194	209	224	239	......	......	
								4	......	......	......	......	......	......	170	......	......	
						10	10.4	1	3596	3963	4330	4698	5065	5432	5799	6534	......	0.313
								2	0.159	0.175	0.191	0.207	0.222	0.238	0.254	0.286	......	
								3	120	132	144	157	169	181	193	218	......	
								4	......	......	......	......	......	......	......	173		

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

3x12	2½x11½	28.75 1.252	316.85 1.364	55.10 1.306	7.590 1.252	11	11.5	1	3257	3591	3925	4259	4593	4927	5261	5929	6597	0.344
								2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0.346	0.384	
								3	99	109	119	129	139	149	159	180	200	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	2970	3276	3582	3888	4194	4501	4807	5419	6031	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	83	91	100	108	117	125	134	151	168	
						13	13.6	1	2729	3012	3295	3577	3860	4143	4426	4991	5557	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	70	77	84	92	99	106	113	128	143	
						14	14.6	1	2517	2779	3042	3304	3566	3829	4091	4615	5140	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0.498	0.561	0.623	
								3	60	66	72	79	85	91	97	110	122	
						15	15.7	1	2336	2581	2826	3071	3316	3561	3806	4296	4786	0.469
								2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	
								3	52	57	63	68	74	79	85	95	106	
						16	16.7	1	2176	2406	2635	2865	3095	3325	3554	4014	4473	0.500
								2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	45	50	55	60	64	69	74	84	93	
						17	17.7	1	2032	2248	2464	2680	2896	3113	3329	3761	4193	0.531
								2	0.459	0.505	0.551	0.597	0.643	0.688	0.734	0.826	0.918	
								3	40	44	48	53	57	61	65	74	82	
						18	18.8	1	1904	2108	2312	2516	2720	2925	3129	3537	......	0.563
								2	0.515	0.566	0.618	0.670	0.721	0.773	0.824	0.927	......	
								3	35	39	43	47	50	54	58	65	......	
						19	19.8	1	1790	1983	2177	2370	2564	2757	2950	......	......	0.594
								2	0.573	0.631	0.688	0.745	0.802	0.860	0.917	......	......	
								3	31	35	38	42	45	48	52	......	......	
						20	20.9	1	1685	1869	2052	2236	2420	2604	......	......	......	0.625
								2	0.635	0.699	0.762	0.826	0 889	0.953	......	......	......	
								3	28	31	34	37	40	43	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									Deflection equivalent to 1/32 Inch per Foot of Span
Rough	Surfaced S1S1E or S4S	A=bh	$I=\frac{bh^3}{12}$	$S=\frac{bh^2}{6}$			l/h		1000	1100	1200	1300	1400	1500	1600	1800	2000	D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						21	21.9	1	1591	1766	1941	2116	2291	......	......	......	......	0.656
								2	0.701	0.771	0.841	0.911	0.981	......	......	......	......	
								3	25	28	31	34	36	......	......	......	......	
						22	23.0	1	1503	1670	1837	2004	......	......	......	......	......	0.688
3x12	2½x11½	28.75	316.85	55.10	7.590			2	0.769	0.846	0.923	1.000	......	......	......	......	......	
		1.252	1.364	1.306	1.252			3	23	25	28	30	......	......	......	......	......	
						23	24.0	1	1423	1583	......	......	......	......	......	......	......	0.719
								2	0.841	0.925	......	......	......	......	......	......	......	
								3	21	23	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
						9	8.0	1	5543	6105	6668	7230	7792	......	......	......	......	0.281
								2	0.110	0.121	0.131	0.142	0.153	......	......	......	......	
								3	176	194	212	230	247	......	......	......	......	
3x14	2½x13½	33.75	512.58	75.94	8.909			4	125	138	150	163	175	......	......	......	......	
		1.245	1.338	1.291	1.245	10	8.9	1	4971	5477	5983	6489	6995	7501	8007	......	......	0.313
								2	0.135	0.149	0.162	0.176	0.189	0.203	0.216	......	......	
								3	142	156	171	185	200	214	229	......	......	
								4	......	......	......	......	......	169	180	......	......	

3x14	2½x13½	33.75	512.58	75.94	8.909	11	9.8	1	3962	4368	4774	5180	5586	5992	6398	7210	......	0.344
		1.245	1.338	1.291	1.245			2	0.164	0.180	0.196	0.213	0.229	0.245	0.262	0.295	......	
								3	103	113	124	135	145	156	166	187	......	
								4	......	......	......	......	......	......	......	184	......	
						12	10.7	1	4112	4534	4956	5378	5800	6222	6643	7487	......	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0.311	0.350	......	
								3	98	108	118	128	138	148	158	178	......	
						13	11.6	1	3776	4165	4554	4944	5333	5722	6111	6890	7668	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0.457	
								3	83	92	100	109	117	126	134	151	169	
								4	......	......	......	......	......	......	......	......	173	
						14	12.4	1	3492	3854	4215	4577	4939	5301	5662	6386	7109	0.438
								2	0 265	0.292	0.318	0.344	0.371	0.397	0.424	0.477	0.530	
								3	71	79	86	93	101	108	116	130	145	
						15	13.3	1	3240	3577	3915	4252	4590	4927	5264	5939	6614	0.469
								2	0.304	0.334	0.365	0.395	0.426	0.456	0 486	0.547	0.608	
								3	62	68	75	81	87	94	100	113	126	
						16	14.2	1	3019	3335	3651	3968	4284	4600	4916	5549	6181	0.500
								2	0 346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0.692	
								3	54	60	65	71	77	82	88	99	110	
						17	15.1	1	2827	3125	3423	3721	4019	4317	4614	5210	5806	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	
								3	48	53	58	63	68	73	78	88	98	
						18	16.0	1	2651	2932	3213	3494	3775	4057	4338	4900	5462	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	42	47	51	55	60	64	69	78	87	
						19	16.9	1	2495	2761	3028	3294	3561	3827	4093	4626	5159	0.594
								2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	38	42	46	50	54	58	62	70	78	
						20	17.8	1	2353	2606	2859	3112	3365	3619	3872	4378	......	0.625
								2	0.541	0.595	0.649	0.703	0.757	0 811	0.865	0.973	......	
								3	34	37	11	44	48	52	55	63	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size, Rough	Size, Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									Deflection equivalent to 1/32 Inch per Foot of Span D
									1000	1100	1200	1300	1400	1500	1600	1800	2000	
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						21	18.7	1	2223	2464	2705	2946	3187	3428	3669	......	......	0.656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	
								3	30	34	37	40	43	47	50			
						22	19.6	1	2105	2335	2565	2795	3025	3256	......	......	......	0.688
								2	0.654	0.719	0.785	0.850	0.915	0.981	......	......	......	
								3	27	30	33	36	39	42				
						23	20.4	1	1996	2216	2436	2656	......			......	......	0.719
								2	0.715	0.787	0.858	0.930	......	......	......	......	......	
3x14	2½x13½	33.75	512.58	75.94	8.909			3	25	28	30	33	......		......	......		
		1.245	1.338	1.291	1.245	24	21.3	1	1896	2107	2318	......	......	......	......	......	......	0.750
								2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	23	25	28	......	......					
						25	22.2	1	1801	2003								0.781
								2	0.844	0.929								
								3	21	23								
						26	23.1	1	1715	......								0.813
								2	0.914	......								
								3	19									
						Multiplying Factor		1	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	
								2	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	

								1	5957	6564	7171	7778	8385	8992		....	....	
						11	8.5	2	0.143	0.157	0.171	0.185	0.200	0.214		...	.....	0.344
								3	135	149	163	177	191	204	..	.. .	.....	
								4	117	129	141	153	164	176	.....	. ..	.....	
								1	5439	5995	6551	7108	7664	8220	8776	..	.....	
						12	9.3	2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	.. .	.. ..	0.375
								3	113	125	137	148	160	171	183	.....	....	
								4	......	......	......	......	... ..	.....	172	.....	.. . .	
								1	5004	5518	6031	6545	7059	7573	8086	9114	......	
						13	10.1	2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	.....	0.406
								3	96	106	116	126	136	146	156	175	......	
								4	......	......	......	......	......	......	.....	179	......	
								1	4626	5103	5580	6057	6534	7011	7487	8441	9395	
						14	10.8	2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	0.438
								3	83	91	100	108	117	125	134	151	168	
								4	......	......	......	......	......	......	......	......	185	
3x16	2½x15½	38.75 1.239	775.81 1.321	100.10 1.279	10.22 1.239			1	4297	4742	5187	5632	6077	6522	6967	7857	8747	
						15	11.6	2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	0.469
								3	72	79	87	94	101	109	116	131	146	
								1	4008	4425	4842	5260	5677	6094	6511	7346	8180	
						16	12.4	2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	0.500
								3	63	69	76	82	89	95	102	115	128	
								1	3754	4147	4540	4932	5325	5718	6111	6896	7682	
						17	13.2	2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	0.531
								3	55	61	67	73	78	84	90	101	113	
								1	3525	3896	4267	4638	5009	5380	5750	6492	7234	
						18	13.9	2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	0.563
								3	49	54	59	64	70	75	80	90	100	
								1	3319	3670	4022	4373	4724	5076	5427	6129	6832	
						19	14.7	2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	0.594
								3	44	48	53	58	62	67	71	81	90	
								1	3135	3469	3803	4137	4471	4805	5138	5806	6474	
						20	15.5	2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	0.625
								3	39	43	48	52	56	60	64	73	81	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						21	16.3	1	2965	3283	3601	3919	4237	4555	4873	5509	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	35	39	43	47	50	54	58	66	......	
						22	17.0	1	2810	3114	3417	3721	4024	4328	4631	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	32	35	39	42	46	49	53	......	......	
						23	17.8	1	2667	2957	3247	3538	3828	4118	4408	......	......	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	......	......	
								3	29	32	35	38	42	45	48	......	......	
3x16	2½x15½	38.75	775.81	100.10	10 22	24	18.6	1	2536	2814	3092	3370	3648	......	......	......	......	0.750
		1 239	1 321	1.279	1.239			2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	26	29	32	35	38	......	......	......	......	
						25	19.4	1	2414	2681	2948	3215	......	......	......	......	......	0.781
								2	0.737	0.811	0.884	0.958	......	......	......	......	......	
								3	24	27	29	32	......	......	......	......	......	
						26	20.1	1	2303	2560	2817	......	......	......	......	......	......	0.813
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	22	25	27	......	......	......	......	......	......	
						27	20.9	1	2196	2443	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	20	23	......	......	......	......	......	......	......	

						28	21.7	1	2098	...	...	...	...	...	...	...	...	0.875
								2	0.923	...	...	...	...	...	...	...	...	
								3	19	...	...	...	...	...	...	...	...	
						Multiplying Factor		1	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						12	8.2	1	6952	7661	8370	9079	9788	10497	...	...	...	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	...	...	...	
								3	129	142	155	168	181	194	...	...	...	
								4	122	134	146	158	170	182	...	...	...	
						13	8.9	1	6393	7047	7702	8356	9010	9665	10319	...	...	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	...	...	
								3	109	121	132	143	154	165	176	...	...	
								4	...	...	...	...	...	...	180	...	...	
						14	9.6	1	5917	6525	7133	7740	8348	8956	9564	...	...	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	...	...	
								3	94	104	113	123	133	142	152	...	...	
						15	10.3	1	5499	6066	6633	7201	7768	8335	8902	10037	...	0.469
3x18	2½x17½	43.75	1116.54	127.60	11.54			2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	...	
								3	82	90	98	107	115	123	132	149	...	
		1.234	1.306	1.269	1.234			4	...	...	...	...	...	...	...	175	...	
						16	11.0	1	5134	5666	6198	6730	7262	7794	8325	9389	10453	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	71	79	86	93	101	108	116	130	145	
								4	...	...	...	...	...	...	...	...	182	
						17	11.7	1	4809	5310	5810	6311	6811	7312	7812	8813	9814	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	63	69	76	83	89	96	102	115	128	
						18	12.3	1	4519	4992	5464	5937	6410	6883	7355	8301	9246	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	56	62	67	73	79	85	91	103	114	
						19	13.0	1	4260	4708	5156	5604	6052	6500	6947	7843	8739	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	50	55	60	66	71	76	81	92	102	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
3x18	2½x17½	43.75 1 234	1116.54 1 306	127.60 1 269	11.54 1 234	20	13.7	1	4023	4448	4874	5299	5725	6150	6575	7426	8277	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	45	49	54	59	64	68	73	83	92	
						21	14 4	1	3809	4214	4619	5024	5429	5835	6240	7050	7860	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0 920	
								3	40	45	49	53	57	62	66	75	83	
						22	15.1	1	3615	4002	4389	4776	5163	5550	5936	6710	......	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	......	
								3	37	40	44	48	52	56	60	68	......	
						23	15.8	1	3435	3805	4175	4545	4915	5285	5655	6395	......	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	......	
								3	33	37	40	44	47	51	55	62	......	
						24	16.5	1	3268	3623	3977	4332	4686	5041	5395	......	......	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	......	......	
								3	30	34	37	40	43	47	50	......	......	
						25	17 1	1	3115	3455	3796	4136	4476	4817	......	......	......	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	......	......	......	
								3	28	31	34	37	40	43	......	......	......	
						26	17 8	1	2972	3299	3625	3954	4281	......	......	......	......	0.813
								2	0.705	0.775	0 846	0.917	0.987	......	......	......	......	
								3	25	28	31	34	37	......	......	......	......	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

3x18	$2\frac{1}{2}$x$17\frac{1}{2}$	43.75	1116.54	127.60	11.54	27	18.5	1	2839	3154	3469	3784	.....	.....	.....	.....	.....	0.844
		1.234	1.306	1.269	1.234			2	0.761	0.837	0.913	0.989	.....	.....	.....	.....	.....	
								3	23	26	29	31	.....	.....	.....	.....	.....	
						28	19.2	1	2717	3021	3325	.....	.....	.....	.....	.....	.....	0.875
								2	0.818	0.900	0.982	.....	.....	.....	.....	.....	.....	
								3	22	24	26	.....	.....	.....	.....	.....	.....	
						29	19.9	1	2599	2892	.....	.....	.....	.....	.....	.....	.....	0.906
								2	0.877	0.965	.....	.....	.....	.....	.....	.....	.....	
								3	20	22	.....	.....	.....	.....	.....	.....	.....	
						30	20.6	1	2491	.....	.....	.....	.....	.....	.....	.....	.....	0.938
								2	0.939	.....	.....	.....	.....	.....	.....	.....	.....	
								3	18	.....	.....	.....	.....	.....	.....	.....	.....	
						Multiplying Factor		1	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	
4x4	$3\frac{1}{2}$x$3\frac{1}{2}$	12.25	12.51	7.15	3.231	3	10.3	1	1579	1738	1897	2056	2215	2374	2532	2850	.....	0.0938
		1 306	1.705	1.492	1.306			2	0.0470	0.0517	0.0564	0.0610	0.0658	0.0705	0.0752	0.0845	.....	
								3	395	435	474	514	554	594	633	712	.....	
								4	97	107	117	127	136	146	156	175	.....	
						4	13.7	1	1179	1298	1417	1537	1656	1775	1894	2133	2371	0.125
								2	0.0835	0.0919	0.100	0 109	0.117	0.125	0.134	0.150	0.167	
								3	221	244	266	288	311	333	355	400	445	
								4	.....	.....	.....	.....	.....	.....	.....	.....	146	
						5	17.1	1	938	1033	1129	1224	1320	1415	1510	1701	1892	0.156
								2	0.131	0.144	0.157	0.170	0.183	0.196	0.209	0.235	0.261	
								3	141	155	169	184	198	212	226	255	284	
						6	20.6	1	776	856	935	1015	1094	1174	1253	1412	1571	0.188
								2	0.188	0.207	0.226	0.245	0.263	0.282	0.301	0.339	0 376	
								3	97	107	117	127	137	147	157	177	197	
						7	24.0	1	658	726	794	862	930	999	1067	1203	1339	0.219
								2	0.256	0.281	0.307	0.332	0.358	0.384	0.409	0.461	0.512	
								3	71	78	85	92	100	107	114	129	144	
						Multiplying Factor		1	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	-
								2	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	
								4	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						4	8.7	1	2920	3214	3508	3802	4096	4390	4684	......	......	0.125
								2	0.0532	0.0585	0.0638	0.0691	0.0744	0.0797	0.0850	......	......	
								3	365	402	438	475	512	549	586	......	......	
								4	115	126	137	149	160	172	183	......	......	
						5	10.9	1	2327	2562	2797	3033	3268	3503	3738	4209	4679	0.156
								2	0.0830	0.0913	0.0996	0.108	0.116	0.125	0.133	0.149	0.166	
								3	233	256	280	303	327	350	374	421	468	
								4	......	......	......	......	......	......	......	165	183	
4x6	3½x5½	19.25 **1.246**	48.53 **1.484**	17.64 **1.361**	5.080 **1.246**	6	13.1	1	1930	2126	2322	2518	2714	2910	3106	3498	3890	0.188
								2	0.120	0.132	0.144	0.155	0.167	0.179	0.191	0.215	0.239	
								3	161	177	194	210	226	243	259	291	324	
						7	15.3	1	1645	1813	1981	2149	2317	2486	2654	2990	3326	0.219
								2	0.163	0.179	0.195	0.212	0.228	0.244	0.261	0.293	0.326	
								3	118	130	142	153	165	178	190	214	237	
						8	17.5	1	1429	1576	1723	1870	2017	2164	2311	2605	2899	0.250
								2	0.213	0.234	0.255	0.276	0.298	0.319	0.340	0.383	0.425	
								3	89	99	108	117	126	135	145	163	181	
						9	19.6	1	1261	1392	1522	1653	1784	1915	2045	2307	2568	0.281
								2	0.269	0.296	0.323	0.350	0.377	0.404	0.431	0.485	0.539	
								3	70	77	85	92	99	106	114	128	143	

						10	21.8	1	1125	1243	1360	1478	1595	1713	1831	2066	2301	0.313
								2	0.332	0.365	0.398	0.432	0.465	0.498	0.531	0.597	0.664	
								3	56	62	68	74	80	86	92	103	115	
						11	24.0	1	1013	1120	1227	1334	1441	1548	1654	1868	2082	0.344
								2	0.402	0.442	0.482	0.522	0.563	0.603	0.643	0.723	0.804	
								3	46	51	56	61	66	70	75	85	95	
						Multiplying Factor		1	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	**1.36**	
								2	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	**0.92**	
								4	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	
4x8	$3\frac{1}{2}$x$7\frac{1}{2}$	26.25	123.05	32.81	6.928	5	8.0	1	4343	4781	5219	5656	6094	.....	.....	.....	.....	0.156
		1.219	**1.386**	**1.300**	**1.219**			2	0.0608	0.0669	0.0730	0.0791	0.0852	.....	.....	.....	.....	
								3	326	359	392	424	457	.....	.....	.....	.....	
								4	125	137	150	162	175	.....	.....	.....	.....	
						6	9.6	1	3606	3971	4336	4700	5065	5430	5795	.....	.....	0.188
								2	0.0876	0.0963	0.105	0.114	0.123	0.131	0.140	.....	.....	
								3	225	248	271	294	317	339	362	.....	.....	
								4	.....	.....	.....	.....	.....	156	167	.....	.....	
						7	11.2	1	3077	3390	3702	4015	4327	4640	4953	5578	6203	0.219
								2	0.119	0.131	0.143	0.155	0.167	0.179	0.191	0.215	0.238	
								3	165	182	198	215	232	249	265	299	332	
								4	.....	.....	.....	.....	.....	.....	.....	161	178	
						8	12.8	1	2680	2954	3227	3501	3774	4048	4321	4868	5415	0.250
								2	0.156	0.171	0.187	0.202	0.218	0.234	0.249	0.280	0.311	
								3	126	139	151	164	177	190	203	228	254	
						9	14.4	1	2369	2612	2855	3098	3341	3585	3828	4314	4800	0.281
								2	0.197	0.217	0.237	0.256	0.276	0.296	0.316	0.355	0.394	
								3	99	109	119	129	139	149	159	180	200	
						10	16.0	1	2119	2338	2557	2775	2994	3213	3432	3869	4307	0.313
								2	0.243	0.267	0.292	0.316	0.340	0.365	0.389	0.438	0.486	
								3	79	88	96	104	112	121	129	145	162	
						11	17.6	1	1913	2112	2311	2510	2709	2908	3106	3504	3902	0.344
								2	0.294	0.324	0.353	0.383	0.412	0.442	0.471	0.530	0.589	
								3	65	72	79	86	92	99	106	119	133	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						12	19.2	1	1740	1922	2105	2287	2469	2652	2834	3198	3563	0.375
								2	0.350	0.385	0.420	0.455	0.490	0.526	0.561	0.631	0.701	
								3	54	60	66	71	77	83	89	100	111	
						13	20.8	1	1593	1761	1930	2098	2266	2435	2603	2939	3276	0.406
								2	0.411	0.452	0.493	0.534	0.576	0.617	0.658	0.740	0.822	
								3	46	51	56	61	65	70	75	85	95	
4x8	3½x7½	26.25	123.05	32.81	6.928	14	22.4	1	1466	1622	1779	1935	2091	2248	2404	2716	3029	0.438
		1.219	1.386	1.300	1.219			2	0.477	0.525	0.572	0.620	0.668	0.716	0.763	0.858	0.954	
								3	39	43	48	52	56	60	64	73	81	
						15	24.0	1	1355	1501	1647	1793	1939	2085	2230	2522	......	0.469
								2	0.548	0.602	0.657	0.712	0.767	0.822	0.876	0.986	......	
								3	34	38	41	45	48	52	56	63	......	
						Multiplying Factor		1	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	
								2	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
								4	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
						7	8.8	1	4956	5458	5959	6461	6963	7465	7966	......	......	0.219
								2	0.0942	0.104	0.113	0.123	0.132	0.141	0.151	......	......	
								3	212	234	255	277	299	320	341	......	......	
								4	113	125	136	147	159	170	181	......	......	

4x10	3½x9½	33.25 1.203	250.07 1.332	52.65 1.265	8.775 1.203	8	10.1	1	4320	4759	5198	5637	6076	6515	6954	7832	......	0.250
								2	0.123	0.135	0.148	0 160	0.172	0.185	0.197	0.222	......	
								3	162	178	195	211	228	244	261	294	......	
								4	......	......	......	......	......	......	......	178	......	
						9	11 4	1	3822	4212	4602	4992	5382	5773	6163	6943	7723	0.281
								2	0.156	0.171	0.187	0.203	0.218	0.234	0.249	0 281	0.312	
								3	127	140	153	166	179	192	206	231	258	
								4	......	......	......	......	......	......	......	......	176	
						10	12 6	1	3423	3774	4125	4476	4827	5179	5530	6232	6934	0.313
								2	0.192	0.212	0.231	0 250	0.269	0.289	0.308	0.346	0.385	
								3	103	113	124	134	145	155	166	187	208	
						11	13.9	1	3095	3414	3733	4053	4372	4691	5010	5649	6287	0.344
								2	0.233	0.256	0.279	0.302	0.326	0.349	0.372	0.419	0.465	
								3	84	93	102	111	119	128	137	154	172	
						12	15 2	1	2822	3115	3407	3700	3993	4286	4578	5164	5749	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	71	78	85	93	100	107	114	129	144	
						13	16.4	1	2587	2857	3127	3397	3667	3938	4208	4748	5288	0.406
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650	
								3	60	66	72	78	85	91	97	110	122	
						14	17.7	1	2386	2637	2888	3139	3390	3641	3891	4393	4895	0.438
								2	0.377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754	
								3	51	57	62	67	73	78	83	94	105	
						15	19.0	1	2209	2443	2677	2911	3145	3380	3614	4082	4550	0.469
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866	
								3	44	49	54	58	63	68	72	82	91	
						16	20.2	1	2054	2373	2493	2712	2932	3151	3370	3809	4248	0.500
								2	0.492	0.542	0.591	0.640	0.689	0.738	0.788	0.886	0.985	
								3	39	45	47	51	55	59	63	71	80	
						17	21.5	1	1916	2123	2329	2536	2742	2949	3155	......	......	0.531
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......	
								3	34	37	41	45	48	52	56	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A = bh$	Moment of Inertia $I = \frac{bh^3}{12}$	Section Modulus $S = \frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
4x10	$3\frac{1}{2}$x$9\frac{1}{2}$	33.25	250.07	52.65	8.775	18	22.7	1	1793	1988	2183	2378	2573	2769	2964	......	......	0.563
								2	0.623	0.686	0.748	0.810	0 873	0.935	0.997	......	......	
								3	30	33	36	40	43	46	49	......	......	
						19	24.0	1	1681	1866	2051	2235	2420	......	......	......	......	0.594
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......	
								3	27	29	32	35	38	......	......	......	......	
		1.203	1.332	1.265	1.203	Multiplying Factor		1	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	
								2	0 95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.05	1 05	1.05	1.05	1.05	1.05	1.05	1 05	1.05	
4x12	$3\frac{1}{2}$x$11\frac{1}{2}$	40 25	443 59	77 15	10 62	8	8.3	1	6342	6985	7627	8270	8913	9556	......	......	......	0.250
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......	
								3	198	218	238	258	279	299	......	......	......	
								4	120	132	144	156	168	180	......	......	......	
		1.193	1.299	1.245	1.193	9	9 4	1	5617	6188	6760	7331	7902	8474	9045	......	......	0.281
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......	
								3	156	172	188	204	220	235	251	......	......	
								4	......	......	......	......	......	......	170	......	......	
						10	10.4	1	5034	5548	6062	6576	7090	7604	8118	9146	......	0.313
								2	0.159	0.175	0.191	0.207	0.222	0.238	0.254	0.286	......	
								3	126	139	152	164	177	190	203	229	......	
								4	......	......	......	......	......	......	......	173	......	

4x12	3½x11½	40.25	443.59	77.15	10.62	11	11 5	1	4557	5024	5492	5959	6427	6894	7361	8296	9231	0.344
		1.193	1.299	1.245	1.193			2	0.192	0 211	0.231	0 250	0.269	0.288	0.307	0.346	0.384	
								3	104	114	125	135	146	157	167	189	210	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	4157	4585	5014	5442	5871	6299	6727	7584	8441	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	87	96	104	113	122	131	140	158	176	
						13	13.6	1	3818	4214	4609	5005	5400	5796	6192	6983	7774	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	73	81	89	96	104	111	119	134	150	
						14	14.6	1	3524	3891	4259	4626	4993	5361	5728	6462	7197	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0 498	0.561	0.623	
								3	63	69	76	83	89	96	102	115	129	
						15	15.7	1	3270	3613	3956	4299	4642	4985	5327	6013	6699	0.469
								2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	
								3	55	60	66	72	77	83	89	100	112	
						16	16 7	1	3043	3364	3686	4007	4328	4650	4971	5613	6256	0.500
								2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	48	53	58	63	68	73	78	88	98	
						17	17.7	1	2843	3145	3448	3750	4053	4355	4657	5262	5867	0.531
								2	0.459	0.505	0.551	0.597	0.643	0.688	0.734	0.826	0.918	
								3	42	46	51	55	60	64	69	77	86	
						18	18.8	1	2667	2953	3239	3524	3810	4096	4382	4953	......	0.563
								2	0.515	0.566	0.618	0.670	0.721	0.773	0.824	0.927	......	
								3	37	41	45	49	53	57	61	69	......	
						19	19.8	1	2506	2777	3048	3318	3589	3860	4131	......	......	0.594
								2	0.573	0.631	0.688	0.745	0.802	0.860	0.917	......	......	
								3	33	37	40	44	47	51	54	......	......	
						20	20.9	1	2359	2616	2873	3130	3387	3645	......	......	......	0.625
								2	0.635	0.699	0.762	0.826	0.889	0.953	......	......	......	
								3	29	33	36	39	42	46	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
						21	21.9	1 2 3	2226 0.701 27	2471 0.771 29	2716 0.841 32	2961 0.911 35	3206 0.981 38	....	....	....	....	0.656
4x12	3½x11½	40.25 1.193	443.59 1.299	77.15 1.245	10.62 1.193	22	23.0	1 2 3	2104 0.769 24	2338 0.846 27	2572 0.923 29	2805 1.000 32	....	....	....	....	....	0.688
						23	24.0	1 2 3	1992 0.841 22	2216 0.925 24	....	....	....	....	....	....	....	0.719
						Multiplying Factor		1 2 4	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	1.25 0.95 1.04	
						9	8.0	1 2 3 4	7766 0.110 185 125	8554 0.121 204 138	9342 0.131 222 150	10129 0.142 241 163	10917 0.153 260 175	....	....	....	....	0.281
4x14	3½x13½	47.25 1.185	717.61 1.275	106.31 1.229	12.46 1.185	10	8.9	1 2 3 4	6961 0.135 149	7670 0.149 164	8378 0.162 180	9087 0.176 195	9795 0.189 210	10504 0.203 225 169	11213 0.216 240 180	....	....	0.313

						11	9.8	1	6305	6949	7593	8238	8882	9526	10170	11459	......	0.344
								2	0.164	0.180	0 196	0.213	0.229	0.245	0.262	0.295	......	
								3	123	135	148	161	173	186	198	223	......	
								4	......	......	....	....	......	......	......	184	.....	
						12	10.7	1	5755	6346	6936	7527	8117	8708	9298	10479	.....	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0.311	0 350	......	
								3	103	113	124	134	145	156	166	187	.....	
						13	11.6	1	5288	5833	6378	6923	7468	8013	8558	9648	10738	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0 457	
								3	87	96	105	114	123	132	141	159	177	
								4	......	.....	......	.....	......	.....	.....	.....	173	
						14	12.4	1	4887	5393	5899	6405	6911	7418	7924	8936	9948	0.438
								2	.0.265	0.292	0.318	0.344	0.371	0.397	0 424	0.477	0.530	
								3	75	83	90	98	106	114	121	137	152	
4x14	3½x13½	47.25	717.61	106.31	12.46	15	13.3	1	4539	5012	5484	5957	6429	6902	7375	8320	9265	0.469
								2	0.304	0.334	0.365	0.395	0.426	0.456	0.486	0.547	0.608	
		1.185	1.275	1.229	1.185			3	65	72	78	85	92	99	105	119	132	
						16	14.2	1	4231	4674	5117	5560	6003	6446	6889	7775	8661	0.500
								2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0 692	
								3	57	63	68	74	80	86	92	104	116	
						17	15.1	1	3958	4375	4792	5209	5626	6043	6460	7294	8128	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0 781	
								3	50	55	60	66	71	76	81	92	103	
						18	16.0	1	3715	4109	4503	4897	5291	5685	6078	6866	7654	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	44	49	54	58	63	68	72	82	91	
						19	16.9	1	3493	3866	4239	4612	4985	5358	5731	6477	7223	0.594
								2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	39	44	48	52	56	60	65	73	81	
						20	17.8	1	3293	3647	4001	4356	4710	5064	5418	6127	......	0.625
								2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	.....	
								3	35	39	43	47	50	54	58	66	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												
						21	18.7	1 2 3	3112 0.596 32	3449 0.656 35	3787 0.716 39	4124 0.775 42	4462 0.835 46	4799 0.895 49	5136 0.954 52	......	......	0.656
						22	19.6	1 2 3	2947 0.654 29	3269 0.719 32	3591 0.785 35	3913 0.850 38	4235 0.915 41	4558 0.981 44	......	......	......	0.688
						23	20.4	1 2 3	2794 0.715 26	3102 0.787 29	3410 0.858 32	3718 0.930 35	......	......	......	......	......	0.719
4x14	3½x13½	47.25 1.185	717.61 1.275	106.31 1.229	12.46 1.185	24	21.3	1 2 3	2653 0.779 24	2948 0.857 26	3243 0.934 29	......	......	......	......	......	......	0.750
						25	22.2	1 2 3	2524 0.844 22	2808 0.929 24	......	......	......	......	......	......	......	0.781
						26	23.1	1 2 3	2403 0.914 20	......	......	......	......	......	......	......	......	0.813
						Multiplying Factor		1 2 4	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	1.23 0.96 1.04	

						11	8.5	1	8341	9191	10041	10890	11740	12590	.....	....	.	0.344
								2	0.143	0.157	0.171	0.185	0.200	0.214	.....	.....	.....	
								3	142	157	171	186	200	214	....	...	....	
								4	117	129	141	153	164	176	.....	..	....	
						12	9 3	1	7616	8395	9174	9952	10731	11510	12289	..		0 375
								2	0 170	0 187	0.204	0 221	0 237	0 254	0 271	..		
								3	119	131	143	155	168	180	192	.....		
								4	......	......	......	......	......	......	172	......	...	
						13	10.1	1	7003	7722	8441	9160	9879	10598	11316	12754	..	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0 358	.	
								3	101	111	122	132	143	153	163	184	.	
								4	......	......	......	......	......	......	.....	179	...	
						14	10.8	1	6478	7146	7814	8481	9149	9817	10485	11820	13156	0.438
								2	0.231	0 254	0.277	0.300	0.324	0.347	0 370	0.416	0 462	
								3	87	96	105	114	123	131	140	158	176	
								4	.....	......	......	......	......	......	.....	.....	185	
4x16	3½x15½	54.25	1086.13	140.15	14.31	15	11.6	1	6015	6638	7261	7884	8507	9130	9753	10999	12245	0.469
		1.180	1.256	1.217	1.180			2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0 530	
								3	75	83	91	99	106	114	122	138	153	
						16	12.4	1	5611	6195	6779	7363	7947	8531	9115	10283	11451	0 500
								2	0.302	0.332	0.362	0.392	0.422	0 453	0.483	0.543	0 603	
								3	66	73	79	86	93	100	107	121	134	
						17	13.2	1	5256	5806	6356	6906	7456	8006	8555	9655	10755	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	58	64	70	76	82	88	94	107	119	
						18	13.9	1	4933	5452	5971	6490	7009	7529	8048	9086	10124	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0 763	
								3	51	57	62	68	73	78	84	95	106	
						19	14.7	1	4647	5139	5631	6123	6615	7107	7598	8582	9566	0.594
								2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0 850	
								3	46	51	56	60	65	70	75	85	94	
						20	15.5	1	4386	4853	5320	5788	6255	6722	7189	8124	9058	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0 754	0.848	0 942	
								3	41	45	50	54	59	63	67	76	85	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						21	16.3	1	4149	4594	5039	5484	5929	6374	6819	7709		0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935		
								3	37	41	45	49	53	57	61	69		
						22	17.0	1	3934	4359	4784	5209	5634	6059	6483			0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912			
								3	34	37	41	44	48	52	55			
						23	17.8	1	3734	4140	4547	4953	5359	5766	6172			0.719
4x16	$3\frac{1}{2}$x$15\frac{1}{2}$	54.25	1086.13	140.15	14.31			2	0.623	0.686	0.748	0.810	0.872	0.935	0.997			
		1.180	**1.256**	**1.217**	**1.180**			3	30	34	37	40	44	47	50			
						24	18.6	1	3550	3939	4329	4718	5108					0.750
								2	0.679	0.746	0.814	0.882	0.950					
								3	28	31	34	37	40					
						25	19.4	1	3382	3756	4130	4504						0.781
								2	0.737	0.811	0.884	0.958						
								3	25	28	31	34						
						26	20.1	1	3223	3583	3942							0.813
								2	0.796	0.876	0.956							
								3	23	26	28							
						27	20.9	1	3075	3421								0.844
								2	0.859	0.945								
								3	21	24								

						28	21.7	1	2938	.....	.....	.....	.....	.....	.....	.....	.....	0.875
								2	0.923	.....	.....	.....	.....	.....	.....	.....	.....	
								3	20	.....	.....	.....	.....	.....	.....	.....	.....	
						Multiplying Factor		1	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						12	8.2	1	9736	10729	11722	12715	13708	14701	.....	.....	.....	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	.....	.....	.....	
								3	135	149	163	177	190	204	.....	.....	.....	
								4	122	134	146	158	170	182	.....	.....	.....	
						13	8.9	1	8957	9874	10790	11707	12624	13541	14457	.....	.....	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	.....	.....	
								3	115	127	138	150	162	174	185	.....	.....	
								4	.....	.....	.....	.....	.....	.....	180	.....	.....	
						14	9.6	1	8289	9141	9992	10844	11695	12547	13398	.....	.....	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	.....	.....	
								3	99	109	119	129	139	149	160	.....	.....	
4x18	3½x17½	61.25 1.175	1563.15 1.244	178.65 1.209	16.16 1.175	15	10.3	1	7703	8498	9292	10087	10881	11676	12470	14059	.....	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	.....	
								3	86	94	103	112	121	130	139	156	.....	
								4	.....	.....	.....	.....	.....	.....	.....	175	.....	
						16	11.0	1	7188	7933	8677	9422	10167	10912	11656	13146	14635	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	75	83	90	98	106	114	121	137	152	
								4	.....	.....	.....	.....	.....	.....	.....	.....	182	
						17	11.7	1	6735	7436	8137	8838	9539	10240	10941	12343	13745	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	66	73	80	87	94	100	107	121	135	
						18	12.3	1	6329	6991	7653	8315	8977	9639	10301	11625	12949	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	59	65	71	77	83	89	95	108	120	
						19	13.0	1	5966	6593	7221	7848	8475	9103	9730	10984	12239	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	52	58	63	69	74	80	85	96	107	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough In.	Size Surfaced S1S1E or S4S In.	Area Cross Section A=bh Sq. In.	Moment of Inertia $I=\frac{bh^3}{12}$ In.⁴	Section Modulus $S=\frac{bh^2}{6}$ In.³	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.) Lbs.	Span Ft.	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D In.
						20	13.7	1	5637	6233	6829	7425	8021	8617	9213	10405	11597	0.625
								2	0 417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	47	52	57	62	67	72	77	87	97	
						21	14 4	1	5338	5906	6473	7041	7609	8177	8744	9880	11015	0.656
								2	0.460	0 506	0.552	0.598	0 644	0.690	0.736	0.828	0.920	
								3	42	47	51	56	60	65	69	78	87	
						22	15.1	1	5063	5605	6117	6689	7231	7773	8314	9398	.....	0.688
								2	0 505	0.556	0.606	0 657	0.708	0.758	0.808	0.909	.....	
								3	38	42	47	51	55	59	63	71	.....	
4x18	3½x17½	61.25	1563.15	178.65	16.16	23	15 8	1	4808	5326	5844	6362	6880	7398	7916	8952	.....	0.719
		1 175	1 244	1 209	1 175			2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0 994	.....	
								3	35	39	42	46	50	54	57	65	.....	
						24	16 5	1	4579	5076	5572	6069	6566	7063	7559	....	.....	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	....	.....	
								3	32	35	39	42	46	49	52	....	.....	
						25	17.1	1	4365	4842	5319	5796	6273	6750	....	....	.....	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	....	....	.....	
								3	29	32	35	39	42	45	....	....	.....	
						26	17.8	1	4164	4622	5081	5539	5998	....		....	.....	0.813
								2	0.705	0.775	0.846	0.917	0.987	....		....	.....	
								3	27	30	33	36	38	....		....	.....	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

4x18	$3\frac{1}{2}$x$17\frac{1}{2}$	61.25 1.175	1563.15 1.244	178.65 1.208	16.16 1.175	27	18.5	1 2 3	3977 0.761 25	4418 0.837 27	4860 0.913 30	5301 0.989 33	... ...	... ...	... ...	... ...	... ...	0.84
						28	19.2	1 2 3	3806 0.818 23	4232 0.900 25	4658 0.982 28	... ...	... ...	... ...	... ...	... ...	... ...	0.875
						29	19.9	1 2 3	3641 0.877 21	4052 0.965 23	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.906
						30	20.6	1 2 3	3488 0.939 19	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.938
						Multiplying Factor		1 2 4	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	1.21 0.97 1.03	
6x6	$5\frac{1}{2}$x$5\frac{1}{2}$	30.25 1.190	76.26 1.416	27.73 1.298	7.980 1.190	4	8.7	1 2 3 4	4591 0.0532 383 115	5053 0.0585 421 126	5516 0.0638 460 137	5978 0.0691 498 149	6440 0.0744 536 160	6903 0.0797 575 172	7365 0.0850 614 183	... ...	... ...	0.125
						5	10.9	1 2 3 4	3660 0.0830 244 ...	4030 0.0913 268 ...	4400 0.0996 293 ...	4770 0.108 318 ...	5140 0.116 343 ...	5510 0.125 367 ...	5880 0.133 392 ...	6620 0.149 441 165	7360 0.166 491 183	0.156
						6	13.1	1 2 3	3035 0.120 169	3343 0.132 186	3652 0.144 203	3960 0.155 220	4268 0.167 237	4577 0.179 254	4885 0.191 271	5501 0.215 306	6118 0.239 340	0.188
						7	15.3	1 2 3	2586 0.163 123	2850 0.179 136	3114 0.195 148	3379 0.212 161	3643 0.228 174	3907 0.244 186	4171 0.261 199	4700 0.293 224	5228 0.326 249	0.219
						8	17.5	1 2 3	2247 0.213 94	2478 0.234 103	2709 0.255 113	2940 0.276 122	3171 0.298 132	3403 0.319 142	3634 0.340 151	4096 0.383 171	4558 0.425 190	0.250

(Table 20 Continued on Next Page)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section $A = bh$	Moment of Inertia $I = \frac{bh^3}{12}$	Section Modulus $S = \frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
6x6	5½x5½	30.25 1.190	76.26 1.416	27.73 1.298	7.980 1.190	9	19.6	1 2 3	1982 0.269 73	2187 0.296 81	2393 0.323 89	2598 0.350 96	2804 0.377 104	3009 0.404 111	3214 0.431 119	3625 0.485 134	4036 0.539 149	0.281
						10	21.8	1 2 3	1769 0.332 59	1954 0.365 65	2139 0.398 71	2324 0.432 77	2509 0.465 84	2694 0.498 90	2878 0.531 96	3248 0.597 108	3618 0.664 121	0.313
						11	24.0	1 2 3	1593 0.402 48	1761 0.442 53	1929 0.482 58	2097 0.522 64	2265 0.563 69	2434 0.603 74	2602 0.643 79	2938 0.723 89	3274 0.804 99	0.344
						Multiplying Factor		1 2 4	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	1.30 0.92 1.09	
6x8	5½x7½	41.25 1.164	193.36 1.324	51.56 1.242	10.88 1.164	5	8.0	1 2 3 4	6818 0.0608 341 125	7505 0.0669 375 137	8192 0.0730 409 150	8880 0.0791 441 162	9567 0.0852 478 175	.... 	....	....	....	0.156
						6	9.6	1 2 3 4	5661 0.0876 236	6234 0.0963 260	6806 0.105 284	7379 0.114 307	7951 0.123 331	8524 0.131 355 156	9097 0.140 379 167	....	....	0.188

Column heading over 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

6x8	5½x7½	41.25 1.164	193.36 1.324	51.56 1.242	10.88 1.164	7	11.2	1	4834	5325	5816	6307	6798	7289	7780	8762	9744	0.219
								2	0.119	0.131	0.143	0.155	0.167	0.179	0.191	0.215	0.238	
								3	173	190	208	225	243	260	278	313	348	
								4	.....	.....	.....	.....	..	.....	...	161	178	
						8	12.8	1	4209	4630	5068	5498	5927	6357	6787	7646	8505	0.250
								2	0.156	0.171	0.187	0.202	0.218	0.234	0.249	0.280	0.311	
								3	131	145	158	172	185	199	212	239	266	
						9	14.4	1	3721	4103	4485	4867	5249	5631	6012	6776	7540	0.281
								2	0.197	0.217	0.237	0.256	0.276	0.296	0.316	0.355	0.394	
								3	103	114	125	135	146	156	167	188	209	
						10	16.0	1	3326	3670	4013	4357	4700	5044	5387	6074	6761	0.313
								2	0.243	0.267	0.292	0.316	0.340	0.365	0.389	0.438	0.486	
								3	83	92	100	109	117	126	135	152	169	
						11	17.6	1	3002	3314	3626	3939	4251	4563	4875	5500	6124	0.344
								2	0.294	0.324	0.353	0.383	0.412	0.442	0.471	0.530	0.589	
								3	68	75	82	90	97	104	111	125	139	
						12	19.2	1	2732	3018	3305	3591	3877	4164	4450	5022	5595	0.375
								2	0.350	0.385	0.420	0.455	0.490	0.526	0.561	0.631	0.701	
								3	57	63	69	75	81	87	93	105	117	
						13	20.8	1	2501	2765	3029	3294	3558	3822	4086	4615	5143	0.406
								2	0.411	0.452	0.493	0.534	0.576	0.617	0.658	0.740	0.822	
								3	48	53	58	63	68	73	79	89	99	
						14	22.4	1	2301	2546	2792	3037	3282	3528	3773	4263	4754	0.438
								2	0.477	0.525	0.572	0.620	0.668	0.716	0.763	0.858	0.954	
								3	41	45	50	54	59	63	67	76	85	
						15	24.0	1	2128	2357	2586	2815	3044	3274	3503	3961	......	0.469
								2	0.548	0.602	0.657	0.712	0.767	0.822	0.876	0.986	......	
								3	35	39	43	47	51	55	58	66	......	
						Multiplying Factor		1	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	
								2	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
								4	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						7	8.8	1	7783	8571	9359	10147	10935	11723	12511	......	......	0.219
								2	0.0942	0.104	0.113	0.123	0.132	0.141	0.151	......	......	
								3	222	245	267	290	312	335	357	......	......	
								4	113	125	136	147	159	170	181	......	......	
						8	10.1	1	6783	7472	8162	8851	9540	10230	10919	12297	......	0.250
								2	0.123	0.135	0.148	0.160	0.172	0.185	0.197	0.222	......	
								3	170	187	204	221	238	256	273	307	......	
								4	....	...	....	.....	......	......	......	178	......	
6x10	5½x9½	52.25	392.96	82.73	13.79	9	11.4	1	6001	6614	7226	7839	8451	9064	9676	10901	12126	0.281
								2	0.156	0.171	0.187	0.203	0.218	0.234	0.249	0.281	0.312	
		1.148	1.273	1.209	1.148			3	133	147	161	174	188	201	215	242	270	
								4	......	......	......	......	......	......	......	......	176	
						10	12.6	1	5376	5927	6479	7030	7582	8133	8684	9787	10890	0.313
								2	0.192	0.212	0.231	0.250	0.269	0.289	0.308	0.346	0.385	
								3	108	119	130	141	152	163	174	196	218	
						11	13.9	1	4860	5361	5862	6364	6865	7366	7867	8870	9872	0.344
								2	0.233	0.256	0.279	0.302	0.326	0.349	0.372	0.419	0.465	
								3	88	97	107	116	125	134	143	161	180	
						12	15.2	1	4429	4888	5348	5807	6267	6726	7185	8104	9023	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	74	82	89	97	104	112	120	135	150	

6x10	5½x9½	52.25 1.148	392.96 1.273	82.73 1.209	13.79 1.148	13	16.4	1	4062	4486	4910	5334	5758	6183	6607	7455	8303
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650
								3	63	69	76	82	89	95	102	115	128
																	0.406
						14	17.7	1	3746	4140	4534	4928	5322	5716	6109	6897	7685
								2	0.377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754
								3	54	59	65	70	76	82	87	99	110
																	0.438
						15	19.0	1	3470	3838	4205	4573	4941	5309	5676	6412	7147
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866
								3	46	51	56	61	66	71	76	85	95
																	0.469
						16	20.2	1	3226	3571	3915	4260	4605	4950	5294	5984	6673
								2	0.492	0.542	0.591	0.640	0.689	0.738	0.788	0.886	0.985
								3	40	45	49	53	58	62	66	75	83
																	0.500
						17	21.5	1	3008	3332	3656	3981	4305	4629	4953	......	......
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......
								3	35	39	43	47	51	54	58	......	......
																	0.531
						18	22.7	1	2814	3120	3426	3733	4039	4345	4651	......	......
								2	0.623	0.686	0.748	0.810	0.873	0.935	0.997	......	......
								3	31	35	38	41	45	48	52	......	......
																	0.563
						19	24.0	1	2640	2930	3220	3511	3801	......	......	......	......
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......
								3	28	31	34	37	40	......	......	......	......
																	0.594
						Multiplying Factor		1	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**
								2	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**
								4	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**
6x12	5½x11½	63.25 1.138	697.07 1.240	121.23 1.188	16.69 1.138	8	8.3	1	9977	10988	11999	13010	14021	15032	......	......	......
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......
								3	208	229	250	271	292	313	......	......	......
								4	120	132	144	156	168	180	......	......	......
																	0.250
						9	9.4	1	8830	9728	10626	11524	12422	13320	14218	......	......
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......
								3	164	180	197	213	230	246	263	......	......
								4	......	......	......	......	......	......	170	......	......
																	0.281

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A = bh$	Moment of Inertia $I = \frac{bh^3}{12}$	Section Modulus $S = \frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						10	10.4	1	7915	8723	9531	10340	11148	11956	12764	14381	......	0.313
								2	0.159	0.175	0.191	0 207	0.222	0.238	0.254	0.286	......	
								3	132	145	159	172	186	199	213	240	......	
								4	......	......	......	......	......	......	......	173	......	
						11	11.5	1	7164	7899	8634	9368	10103	10838	11573	13042	14512	0.344
								2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0.346	0.384	
								3	109	120	131	142	153	164	175	198	220	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	6538	7212	7886	8559	9233	9907	10581	11908	13276	0.375
6x12	5½x11½	63.25	697.07	121.23	16.69			2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	91	100	111	119	128	138	147	166	184	
		1.138	1.240	1.188	1.138	13	13.6	1	6002	6624	7246	7868	8490	9112	9733	10977	12221	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	77	85	93	101	109	117	125	141	159	
						14	14.6	1	5539	6116	6694	7271	7848	8426	9003	10157	11312	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0.498	0.561	0.623	
								3	66	73	80	87	93	100	107	121	135	
						15	15.7	1	5139	5678	6217	6756	7295	7834	8372	9450	10528	0.469
								2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	
								3	57	63	69	75	81	87	93	105	117	
						16	16.7	1	4785	5290	5795	6301	6806	7311	7816	8827	9837	0.500
								2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	50	55	60	66	71	76	81	92	102	

6x12	5½x11½	63.25 **1.138**	697.07 **1.240**	121.23 **1.188**	16.69 **1.138**	17	17.7	1 2 3	4470 0.459 44	4945 0.505 48	5421 0.551 53	5896 0.597 58	6372 0.643 62	6847 0.688 67	7322 0.734 72	8273 0.826 81	9224 0.918 90	0.531
						18	18.8	1 2 3	4191 0.515 39	4640 0.566 43	5089 0.618 47	5538 0.670 51	5987 0.721 55	6437 0.773 60	6886 0.824 64	7784 0.927 72	....	0.563
						19	19.8	1 2 3	3937 0.573 35	4362 0.631 38	4788 0.688 42	5213 0.745 46	5639 0.802 49	6064 0.860 53	6489 0.917 57	....	....	0.594
						20	20.9	1 2 3	3707 0.635 31	4111 0.699 34	4515 0.762 38	4919 0.826 41	5323 0.889 44	5728 0.953 48	....	....	....	0.625
						21	21.9	1 2 3	3500 0.701 28	3885 0.771 31	4270 0.841 34	4655 0.911 37	5040 0.981 40	....	....	....	....	0.656
						22	23.0	1 2 3	3307 0.769 25	3674 0 846 28	4042 0.923 31	4409 1.000 33	....	....	....	....	....	0.688
						23	24.0	1 2 3	3130 0.841 23	3481 0.925 25	....	....	....	....	....	....	....	0.719
						Multiplying Factor		1 2 4	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	**1.19** **0.95** **1.04**	
6x14	5½x13½	74.25 **1.131**	1127.67 **1.216**	167.06 **1.173**	19.60 **1.131**	9	8.0	1 2 3 4	12194 0.110 194 125	13431 0.121 213 138	14668 0.131 233 150	15905 0.142 253 163	17142 0.153 272 175	....	....	....	....	0.281
						10	8.9	1 2 3 4	10944 0.135 156	12058 0.149 172	13172 0.162 188	14286 0.176 204	15400 0.189 220	16514 0.203 236 169	17628 0.216 252 180	....	....	0.313
						11	9.8	1 2 3 4	9904 0.164 129	10916 0.180 142	11928 0.196 155	12940 0.213 168	13952 0.229 181	14964 0.245 194	15976 0.262 208	18000 0.295 234 184	....	0.344

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
6x14	5½x13½	74.25	1127.67	167.06	19.60	12	10.7	1	9045	9973	10901	11829	12757	13685	14613	16469	......	0.375
		1 131	1 216	1 173	1 131			2	0.195	0.214	0.234	0 253	0.273	0.292	0.311	0.350	......	
								3	108	119	130	141	152	163	174	196	......	
						13	11.6	1	8310	9167	10023	10880	11736	12593	13449	15162	16875	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0.457	
								3	91	101	110	120	129	138	148	167	186	
								4	....	....	......	....	......	....	......	.....	173	
						14	12 4	1	7681	8477	9272	10068	10863	11659	12454	14045	15636	0 438
								2	0 265	0 292	0 318	0 344	0 371	0.397	0.424	0.477	0.530	
								3	78	87	95	103	111	119	127	143	159	
						15	13 3	1	7128	7870	8612	9355	10097	10839	11581	13066	14550	0.469
								2	0.304	0.334	0 365	0.395	0.426	0 456	0.486	0.547	0.608	
								3	68	75	82	89	96	103	110	124	139	
						16	14.2	1	6646	7342	8038	8734	9430	10126	10822	12214	13606	0.500
								2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0.692	
								3	59	65	72	78	84	90	97	109	121	
						17	15.1	1	6218	6873	7528	8183	8838	9494	10149	11459	12769	0.531
								2	0.391	0.430	0.469	0.508	0.547	0 586	0.625	0.703	0.781	
								3	52	58	63	69	74	80	85	95	107	
						18	16 0	1	5832	6451	7069	7688	8306	8925	9543	10780	12017	0.563
								2	0 438	0 482	0 526	0 570	0 613	0 657	0 701	0.789	0.876	
								3	46	51	56	61	66	71	76	86	95	

6x14	5½x13½	74.25	1127.67	167.06	19.60	19	16.9	1	5488	6074	6660	7246	7832	8418	9004	10176	11348	0.594
		1.131	1.216	1.173	1.131			2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	41	46	50	54	59	63	68	77	85	
						20	17.8	1	5176	5733	6290	6846	7403	7960	8517	9631	....	0.625
								2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	....	
								3	37	41	45	49	53	57	61	69	....	
						21	18.7	1	4890	5420	5950	6481	7011	7541	8071	....	....	0 656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	....	....	
								3	33	37	40	44	48	51	55	....	....	
						22	19.6	1	4630	5136	5642	6148	6654	7161	....	....	....	0.688
								2	0.654	0.719	0.785	0.850	0.915	0.981	....	....	....	
								3	30	33	37	40	43	46	....	....	....	
						23	20.4	1	4391	4875	5359	5844	....	....	....	....	....	0 719
								2	0.715	0.787	0.858	0.930	....	....	....	....	....	
								3	27	30	33	36	....	....	....	....	....	
						24	21.3	1	4170	4634	5098	....	....	....	....	....	....	0.750
								2	0.779	0.857	0.934	....	....	....	....	....	....	
								3	25	28	30	....	....	....	....	....	....	
						25	22.2	1	3966	4412	....	....	....	....	....	....	....	0.781
								2	0.844	0.929	....	....	....	....	....	....	....	
								3	23	25	....	....	....	....	....	....	....	
						26	23.1	1	3773	....	....	....	....	....	....	....	....	0.813
								2	0.914	....	....	....	....	....	....	....	....	
								3	21	....	....	....	....	....	....	....	....	
						Multiplying Factor		1	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	
								2	0.96	0.96	0.96	0.96	0.96	0.96	0 96	0.96	0.96	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1 04	1.04	1.04	
6x16	5½x15½	85.25	1706.78	220.23	22.50	11	8.5	1	13103	14438	15773	17108	18443	19778	....	....	....	0.344
		1.126	1.200	1.162	1.126			2	0.143	0.157	0.171	0.185	0.200	0.214	....	....	....	
								3	149	164	179	195	210	225	....	....	....	
								4	117	129	141	153	164	176	....	....	....	
						12	9.3	1	11970	13194	14418	15642	16866	18090	19314	....	....	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	....	....	
								3	125	137	150	163	176	188	201	....	....	
								4	....	....	....	....	....	....	172	....	....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						13	10.1	1	11007	12137	13267	14397	15527	16657	17787	20047	.....	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	.....	
								3	106	117	128	138	149	160	171	193	.....	
								4	.....	.....	.....	.....	.....	.....	.....	179	.....	
						14	10.8	1	10175	11224	12273	13322	14371	15420	16469	18567	20665	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	91	100	110	119	128	138	147	166	184	
								4	.....	.....	.....	.....	.....	.....	.....	.....	185	
6x16	5½x15½	85.25	1706.78	220.23	22.50	15	11.6	1	9458	10438	11417	12397	13376	14356	15335	17294	19253	0.469
		1.126	1.200	1.162	1.126			2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	
								3	79	87	95	103	111	120	128	144	160	
						16	12.4	1	8820	9738	10656	11574	12492	13410	14328	16164	18000	0.500
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	
								3	69	76	83	90	98	105	112	126	141	
						17	13.2	1	8258	9122	9986	10850	11714	12578	13442	15170	16898	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	61	67	73	80	86	93	99	112	124	
						18	13.9	1	7755	8571	9387	10203	11019	11835	12651	14283	15915	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	54	59	65	71	76	82	88	99	110	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

6x16	5½x15½	85.25	1706.78	220.23	22.50	19	14.7	1	7308	8082	8855	9629	10402	11176	11949	13496	15043	0.594
		1.126	1.200	1.162	1.126			2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	48	53	58	63	68	74	79	89	99	
						20	15.5	1	6892	7626	8360	9095	9829	10563	11297	12766	14234	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	43	48	52	57	61	66	71	80	89	
						21	16.3	1	6526	7226	7926	8625	9325	10025	10725	12124	...	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	...	
								3	39	43	47	51	55	60	64	72	...	
						22	17.0	1	6184	6852	7520	8188	8856	9524	10191	...	...	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	...	...	
								3	35	39	43	46	50	54	58	...	...	
						23	17.8	1	5871	6510	7149	7787	8426	9065	9704	...	...	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	...	...	
								3	32	35	39	42	46	49	53	...	...	
						24	18.6	1	5580	6192	6804	7416	8028	...	...	...	...	0.750
								2	0.679	0.746	0.814	0.882	0.950	...	...	...	...	
								3	29	32	35	39	42	...	...	...	...	
						25	19.4	1	5316	5904	6492	7079	...	...	...	...	...	0.781
								2	0.737	0.811	0.884	0.958	...	...	...	...	...	
								3	27	30	32	35	...	...	...	...	...	
						26	20.1	1	5064	5629	6194	...	...	...	...	...	...	0.813
								2	0.796	0.876	0.956	...	...	...	...	...	...	
								3	24	27	30	...	...	...	...	...	...	
						27	20.9	1	4833	5377	...	...	...	...	...	...	...	0.844
								2	0.859	0.945	...	...	...	...	...	...	...	
								3	22	25	...	...	...	...	...	...	...	
						28	21.7	1	4615	...	...	...	...	...	...	...	...	0.875
								2	0.923	...	...	...	...	...	...	...	...	
								3	21	...	...	...	...	...	...	...	...	
						Multiplying Factor		1	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						12	8.2	1	15285	16844	18403	19962	21521	23080	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	141	156	170	185	199	214	......	......	......	
								4	122	134	146	158	170	182	......	......	......	
						13	8.9	1	14060	15499	16938	18377	19816	21255	22694	......	......	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	120	132	145	157	169	182	194	......	......	
								4	......	......	......	......	......	......	180	......	......	
						14	9.6	1	13009	14345	15681	17017	18353	19689	21025	......	......	0.438
6x18	$5\frac{1}{2}$x$17\frac{1}{2}$	96.25	2456.38	280.73	25.40			2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
								3	103	114	125	135	146	156	167	......	......	
		1.122	**1.188**	**1.155**	**1.122**	15	10.3	1	12089	13336	14583	15830	17077	18324	19571	22065	......	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	......	
								3	90	99	108	117	126	136	145	164	......	
								4	......	......	......	......	......	......	......	175	......	
						16	11.0	1	11293	12463	13633	14803	15973	17143	18313	20653	22993	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	78	87	95	103	111	119	127	143	160	
								4	......	......	......	......	......	......	......	......	182	
						17	11.7	1	10578	11679	12780	13881	14982	16083	17184	19386	21588	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	69	76	84	91	98	105	112	127	141	

6x18	5½x17½	96.25 1.122	2456.38 1.182	280.73 1.155	25.40 1.122	18	12.3	1	9943	10983	12023	13063	14103	15143	16183	18263	20343	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	61	68	74	81	87	93	100	113	126	
						19	13.0	1	9364	10349	11333	12318	13303	14288	15272	17242	19211	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	55	60	66	72	78	84	89	101	112	
						20	13.7	1	8849	9785	10720	11656	12592	13528	14463	16335	18206	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	49	54	60	65	70	75	80	91	101	
						21	14.4	1	8377	9268	10159	11050	11941	12832	13723	15505	17287	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	44	49	54	59	63	68	73	82	91	
						22	15.1	1	7946	8797	9647	10498	11348	12199	13049	14750	.....	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	.....	
								3	40	44	49	53	57	62	66	75	.....	
						23	15.8	1	7553	8367	9180	9994	10808	11622	12435	14063	.....	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	.....	
								3	36	40	44	48	52	56	60	68	.....	
						24	16.5	1	7189	7969	8749	9529	10309	11089	11868	.....	.....	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	.....	.....	
								3	33	37	40	44	48	51	55	.....	.....	
						25	17.1	1	6849	7597	8346	9094	9843	10591	.....	.....	.....	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	.....	.....	.....	
								3	30	34	37	40	44	47	.....	.....	.....	
						26	17.8	1	6539	7259	7979	8699	9419	.....	.....	.....	.....	0.813
								2	0.705	0.775	0.846	0.917	0.987	.....	.....	.....	.....	
								3	28	31	34	37	40	.....	.....	.....	.....	
						27	18.5	1	6244	6937	7630	8323	.....	.....	.....	.....	.....	0.844
								2	0.761	0.837	0.913	0.989	.....	.....	.....	.....	.....	
								3	26	29	31	34	.....	.....	.....	.....	.....	
						28	19.2	1	5971	6639	7307	.....	.....	.....	.....	.....	.....	0.875
								2	0.818	0.900	0.982	.....	.....	.....	.....	.....	.....	
								3	24	26	29	.....	.....	.....	.....	.....	.....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						29	19.9	1	5716	6361	.....	.....	.....	.....	.....	.....	.....	0.906
								2	0.877	0.965	.....	.....	.....	.....	.....	.....	.....	
								3	22	24	.....	.....	.....	.....	.....	.....	.....	
6x18	5½x17½	96.25	2456.38	280.73	25.40	30	20.6	1	5477	.....	.....	.....	.....	.....	.....	.....	.....	0.938
		1.122	1.188	1.155	1.122			2	0.939	.....	.....	.....	.....	.....	.....	.....	.....	
								3	20	.....	.....	.....	.....	.....	.....	.....	.....	
						Multiplying Factor		1	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						14	8.6	1	16204	17864	19524	21184	22844	24504	.....	.....	.....	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	.....	.....	.....	
								3	116	129	139	151	163	175	.....	.....	.....	
								4	116	128	139	151	163	174	.....	.....	.....	
6x20	5½x19½	107.25	3398.49	348.56	28.30	15	9.2	1	15065	16614	18163	19712	21261	22810	24359	.....	.....	0.469
		1.119	1.177	1.148	1.119			2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	.....	.....	
								3	100	111	121	131	142	152	162	.....	.....	
								4	.....	.....	.....	.....	.....	.....	173	.....	.....	
						16	9.8	1	14067	15519	16971	18423	19875	21327	22779	25683	.....	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	.....	
								3	88	97	106	115	124	133	142	161	.....	
								4	.....	.....	.....	.....	.....	.....	.....	183	.....	

6x20	5½x19½	107.25 1.119	3398.49 1.177	348.56 1.148	28.30 1.119	17	10.5	1	13179	14545	15911	17277	18643	20009	21375	24107	......	0.531
								2	0.271	0.298	0.324	0.352	0.379	0 406	0.433	0.487	......	
								3	78	86	94	102	110	118	126	142	......	
						18	11.1	1	12401	13692	14983	16274	17565	18856	20147	22729	25311	0.563
								2	0.304	0.334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	69	76	83	90	98	105	112	126	141	
								4	......	......	......	......	......	......	......	......	181	
						19	11 7	1	11692	12915	14138	15361	16584	17807	19030	21476	23922	0.594
								2	0.338	0 372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	62	68	74	81	87	94	100	113	126	
						20	12.3	1	11044	12205	13366	14527	15688	16849	18010	20332	22654	0.625
								2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	55	61	67	73	78	84	90	102	113	
						21	12.9	1	10466	11572	12678	13784	14890	15996	17102	19314	21526	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0 826	
								3	50	55	60	66	71	76	81	92	103	
						22	13.5	1	9937	10993	12049	13105	14161	15217	16273	18385	20497	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	45	50	55	60	64	69	74	84	93	
						23	14.2	1	9449	10459	11469	12479	13489	14499	15509	17529	19549	0.719
								2	0.496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	
								3	41	45	50	54	59	63	67	76	85	
						24	14.8	1	9001	9969	10937	11905	12873	13841	14809	16745	......	0.750
								2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	......	
								3	38	42	46	50	54	58	62	70	......	
						25	15.4	1	8587	9517	10446	11376	12305	13235	14164	......	......	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	
								3	34	38	42	46	49	53	57	......	......	
						26	16.0	1	8203	9097	9991	10885	11779	12673	......	......	......	0.813
								2	0.633	0.696	0.760	0.824	0.887	0.950	......	......	......	
								3	32	35	38	42	45	49	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						27	16.6	1	7841	8702	9562	10423	11283	...	...	...	...	0.844
								2	0.683	0.752	0.820	0.888	0.956	...	...	...	...	
								3	29	32	35	39	42	...	...	...	...	
						28	17.2	1	7508	8338	9168	9998	...	...	...	...	...	0.875
								2	0.735	0.808	0.882	0.955	...	...	...	...	...	
								3	27	30	33	36	...	...	...	...	...	
						29	17.8	1	7194	7996	8797	...	...	...	...	...	...	0.906
								2	0.788	0.867	0.946	...	...	...	...	...	...	
6x20	5½x19½	107.25	3398.49	348.56	28.30			3	25	28	30	...	...	...	...	...	...	
		1.119	1.177	1.148	1.119	30	18.5	1	6896	7671	...	...	...	...	...	...	...	0.938
								2	0.843	0.928	...	...	...	...	...	...	...	
								3	23	26	...	...	...	...	...	...	...	
						31	19.1	1	6621	7371	...	...	...	...	...	...	...	0.969
								2	0.901	0.991	...	...	...	...	...	...	...	
								3	21	24	...	...	...	...	...	...	...	
						32	19.7	1	6354	...	...	...	...	...	...	...	...	1.000
								2	0.959	...	...	...	...	...	...	...	...	
								3	20	...	...	...	...	...	...	...	...	
						Multiplying Factor		1	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.51	1.15	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

8x8	$7\frac{1}{2}$x$7\frac{1}{2}$	56.25 1.138	263.67 1 295	70 31 1.214	14.85 1 138	5	8 0	1	9299	10236	11174	12111	13058	...	...	...	...	0.156
								2	0.0608	0.0669	0.0730	0 0791	0 0852	...	...	...	...	
								3	349	384	419	454	490	...	...	...	...	
								4	125	137	150	162	175	...	...	...	...	
						6	9 6	1	7721	8502	9283	10064	10845	11626	12407	...	...	0.188
								2	0.0876	0 0963	0 105	0.114	0.123	0 131	0 140	...	...	
								3	241	266	290	315	339	364	388	...	...	
								4	...	...	...	...	...	156	167	...	...	
						7	11 2	1	6593	7263	7932	8602	9272	9942	10611	11951	13290	0.219
								2	0 119	0.131	0.143	0.155	0 167	0.179	0 191	0.215	0 238	
								3	177	195	213	231	248	266	284	320	356	
								4	...	...	...	...	...	...	...	161	178	
						8	12 8	1	5740	6326	6912	7498	8084	8670	9255	10427	11599	0 250
								2	0.156	0.171	0 187	0.202	0.218	0.234	0 249	0.280	0.311	
								3	135	148	162	176	189	203	217	244	272	
						9	14.4	1	5073	5594	6114	6635	7156	7677	8197	9239	10280	0.281
								2	0.197	0.217	0.237	0.256	0.276	0.296	0.316	0.355	0.394	
								3	106	117	127	138	149	160	171	193	214	
						10	16.0	1	4536	5005	5473	5942	6410	6879	7347	8284	9221	0.313
								2	0.243	0.267	0.292	0.316	0.340	0.365	0.389	0.438	0.486	
								3	85	94	103	111	120	129	138	155	173	
						11	17.6	1	4097	4523	4949	5375	5801	6227	6653	7505	8357	0.344
								2	0.294	0.324	0.353	0.383	0.412	0.442	0.471	0.530	0.589	
								3	70	77	84	92	99	106	113	128	142	
						12	19.2	1	3726	4116	4507	4897	5288	5678	6068	6849	7630	0.375
								2	0.350	0.385	0.420	0.455	0.490	0.526	0.561	0.631	0 701	
								3	58	64	70	77	83	89	95	107	119	
						13	20.8	1	3411	3771	4132	4492	4853	5213	5573	6294	7015	0 406
								2	0.411	0.452	0.493	0.534	0.576	0 617	0.658	0.740	0.822	
								3	49	54	60	65	70	75	80	91	101	
						14	22.4	1	3140	3475	3810	4144	4479	4814	5149	5818	6488	0.438
								2	0.477	0.525	0.572	0.620	0.668	0.716	0.763	0.858	0.954	
								3	42	47	51	55	60	64	69	78	87	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
8x8	7½x7½	56.25	263.67	70.31	14.85	15	24.0	1	2900	3212	3525	3837	4149	4462	4774	5398	......	0.469
								2	0.548	0.602	0.657	0.712	0.767	0.822	0.876	0.986	......	
								3	36	40	44	48	52	56	60	67	......	
		1.138	1.295	1.214	1.138	Multiplying Factor		1	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	
								2	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
								4	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
8x10	7½x9½	71.25	535.86	112.81	18.80	7	8.8	1	10618	11693	12768	13843	14918	15993	17068	......	......	0.219
		1.123	1.244	1.182	1.123			2	0.0942	0.104	0.113	0.123	0.132	0.141	0.151	......	......	
								3	228	251	274	297	320	343	366	......	......	
								4	113	125	136	147	159	170	181	......	......	
						8	10.1	1	9250	10190	11130	12070	13010	13950	14890	16770	......	0.250
								2	0.123	0.135	0.148	0.160	0.172	0.185	0.197	0.222	......	
								3	174	191	209	226	244	262	279	315	......	
								4	......	......	......	......	......	......	......	178	......	
						9	11.4	1	8185	9020	9856	10691	11527	12362	13197	14868	16539	0.281
								2	0.156	0.171	0.187	0.203	0.218	0.234	0.249	0.281	0.312	
								3	136	150	164	178	192	206	220	248	276	
								4	......	......	......	......	......	......	......	......	176	
						10	12.6	1	7332	8084	8836	9588	10340	11092	11844	13348	14852	0.313
								2	0.192	0.212	0.231	0.250	0.269	0.289	0.308	0.346	0.385	
								3	110	121	133	144	155	166	178	200	223	

Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated (columns 1000–2000).

8x10	7½x9½	71.25	535.86	112.81	18.80	11	13.9	1	6629	7313	7996	8680	9363	10047	10731	12098	13465	0.344
		1.123	1.244	1.182	1.123			2	0.233	0.256	0.279	0.302	0.326	0.349	0.372	0.419	0.465	
								3	90	100	109	118	128	137	146	165	184	
						12	15.2	1	6039	6666	7292	7919	8545	9172	9798	11051	12304	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	76	83	91	99	107	115	122	138	154	
						13	16.4	1	5540	6118	6697	7275	7854	8432	9010	10167	11324	0.406
								2	0.325	0.357	0.390	0.422	0.455	0.487	0.520	0.585	0.650	
								3	64	71	77	84	91	97	104	117	131	
						14	17.7	1	5107	5644	6181	6718	7255	7792	8329	9403	10477	0.438
								2	0.377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754	
								3	55	60	66	72	78	83	89	101	112	
						15	19.0	1	4731	5232	5734	6235	6736	7238	7739	8741	9744	0.469
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866	
								3	47	52	57	62	67	72	77	87	97	
						16	20.2	1	4399	4869	5339	5809	6279	6749	7219	8159	9099	0.500
								2	0.492	0.542	0.591	0.640	0.689	0.738	0.788	0.886	0.985	
								3	41	46	50	54	59	63	68	76	85	
						17	21.5	1	4103	4545	4988	5430	5872	6315	6757	......	......	0.531
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......	
								3	36	40	44	48	52	56	60	......	......	
						18	22.7	1	3841	4259	4677	5095	5513	5931	6348	......	......	0.563
								2	0.623	0.686	0.748	0.810	0.873	0.935	0.997	......	......	
								3	32	35	39	42	46	49	53	......	......	
						19	24.0	1	3602	3998	4394	4790	5186	......	......	......	......	0.594
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......	
								3	28	32	35	38	41	......	......	......	......	
						Multiplying Factor		1	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						8	8.3	1	13588	14965	16342	17719	19096	20473	......	......	......	0.250
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......	
								3	212	234	255	277	298	320	......	......	......	
								4	120	132	144	156	168	180	......	......	......	
						9	9.4	1	12035	13259	14483	15707	16931	18155	19379	......	......	0.281
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......	
								3	167	184	201	218	235	252	269	......	......	
								4	......	......	......	......	......	......	170	......	......	
						10	10.4	1	10792	11892	12996	14098	15200	16302	17404	19608	......	0.313
8x12	7½x11½	86.25	950.55	165.31	22.75			2	0.159	0.175	0.191	0.207	0.222	0.238	0.254	0.286	......	
								3	135	149	163	176	190	204	218	245	......	
		1.113	1.212	1.162	1.113			4	......	......	......	......	......	......	......	173	......	
						11	11.5	1	9770	10772	11774	12776	13778	14780	15782	17786	19790	0.344
								2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0.346	0.384	
								3	111	122	134	145	157	168	179	202	225	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	8907	9825	10743	11661	12579	13497	14415	16251	18087	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	93	102	112	122	131	141	150	169	188	
						13	13.6	1	8182	9030	9878	10725	11573	12421	13269	14964	16660	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	79	87	95	103	111	119	128	144	160	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

8x12	7½x11½	86.25	950.55	165.31	22.75	14	14.6	1	7552	8339	9126	9913	10700	11488	12275	13849	15423	0.438
		1.113	1.212	1.162	1.113			2	0.312	0.343	0.374	0.405	0.436	0 467	0 498	0.561	0.623	
								3	67	74	81	88	96	103	110	124	138	
						15	15.7	1	7005	7740	8474	9209	9943	10678	11413	12882	14351	0.469
								2	0 358	0.393	0.429	0.465	0 500	0.536	0.572	0.643	0.715	
								3	58	64	71	77	83	89	95	107	120	
						16	16.7	1	6523	7212	7900	8589	9278	9969	10655	12033	13410	0.500
								2	0.407	0 447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	51	56	62	67	73	78	83	94	105	
						17	17.7	1	6093	6741	7389	8037	8685	9333	9981	11277	12573	0.531
								2	0.459	0.505	0.551	0.597	0.643	0.688	0.734	0.826	0.918	
								3	45	50	54	59	64	69	73	83	92	
						18	18.8	1	5710	6322	6934	7546	8158	8770	9382	10606	......	0.563
								2	0.515	0.566	0.618	0.670	0.721	0.773	0.824	0.927	......	
								3	40	44	48	52	57	61	65	74	......	
						19	19.8	1	5368	5948	6528	7108	7688	8268	8848	......	......	0.594
								2	0.573	0.631	0 688	0.745	0.802	0.860	0.917	......	......	
								3	35	39	43	47	51	54	58	......	......	
						20	20.9	1	5055	5606	6157	6708	7259	7810	......	......	......	0.625
								2	0.635	0.699	0.762	0.826	0.889	0 953	......	......	......	
								3	32	35	38	42	45	49	......	......	......	
						21	21.9	1	4770	5295	5820	6344	6869	......	......	......	......	0.656
								2	0.701	0.771	0.841	0.911	0.981	......	......	......	......	
								3	28	32	35	38	41	......	......	......	......	
						22	23.0	1	4509	5010	5511	6012	......	......	......	......	......	0.688
								2	0.769	0.846	0.923	1.000	......	......	......	......	......	
								3	26	28	31	34	......	......	......	......	......	
						23	24.0	1	4267	4746	......	......	......	......	......	......	......	0.719
								2	0.841	0.925	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.04	1.04	1.04	1.04	1 04	1.04	1.04	1.04	1.04	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						9	8.0	1	16629	18316	20003	21690	23377	......	......	......	......	0.281
								2	0.110	0.121	0.131	0.142	0.153	......	......	......	......	
								3	198	218	238	258	278	......	......	......	......	
								4	125	138	150	163	175	......	......	......	......	
						10	8.9	1	14923	16442	17961	19480	20999	22518	24037	......	......	0.313
								2	0.135	0.149	0.162	0.176	0.189	0.203	0.216	......	......	
								3	160	176	193	209	225	241	258	......	......	
								4	......	......	......	......	......	169	180	......	......	
8x14	7½x13½	101.25	1537.74	227.81	26.72	11	9.8	1	13516	14897	16278	17659	19040	20421	21802	24564	......	0.344
		1.106	1.189	1.148	1.106			2	0.164	0.180	0.196	0.213	0.229	0.245	0.262	0.295	......	
								3	132	146	159	173	186	200	213	240	......	
								4	......	......	......	......	......	......	......	184	......	
						12	10.7	1	12329	13594	14859	16124	17389	18654	19919	22449	......	0.375
								2	0.195	0.214	0.234	0.253	0.213	0.292	0.311	0.350	......	
								3	110	121	133	144	155	167	178	201	......	
						13	11.6	1	11333	12501	13669	14837	16005	17173	18341	20677	23013	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0.457	
								3	93	103	113	122	132	142	151	170	190	
								4	......	......	......	......	......	......	......	......	173	
						14	12.4	1	10476	11561	12646	13731	14816	15901	16986	19156	21326	0.438
								2	0.265	0.292	0.318	0.344	0.371	0.397	0.424	0.477	0.530	
								3	80	88	97	105	113	122	130	147	163	

8x14	7½x13½	101.25	1537.74	227.81	26.72	15	13 3	1	9719	10731	11743	12755	13767	14779	15791	17815	19839	0 469
		1.106	1.189	1 148	1.106			2	0.304	0.334	0.365	0 395	0.426	0.456	0 486	0.547	0.608	
								3	69	77	84	91	98	106	113	127	142	
						16	14.2	1	9062	10011	10960	11909	12858	13807	14756	16654	18552	0.500
								2	0.346	0.381	0.415	0 450	0.484	0.519	0.553	0.623	0.692	
								3	61	67	73	80	86	93	99	112	124	
						17	15.1	1	8480	9373	10267	11160	12054	12947	13840	15627	17414	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	
								3	53	59	65	70	76	82	87	99	110	
						18	16.0	1	7954	8798	9641	10485	11328	12172	13015	14702	16389	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	47	52	57	62	67	72	78	88	98	
						19	16.9	1	7482	8281	9080	9879	10678	11477	12276	13874	15472	0.594
								2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	42	47	51	56	60	65	69	78	87	
						20	17.8	1	7055	7814	8573	9332	10091	10850	11609	13127	......	0.625
								2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	......	
								3	38	42	46	50	54	58	62	70	......	
						21	18.7	1	6669	7392	8115	8838	9561	10284	11007	......	......	0 656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	
								3	34	38	41	45	49	52	56	......	......	
						22	19 6	1	6312	7002	7692	8382	9072	9762	......	......	......	0 688
								2	0.654	0.719	0.785	0.850	0.915	0.981	......	......	......	
								3	31	34	37	41	44	48	......	......	......	
						23	20.4	1	5985	6645	7305	7965	......	......	......	......	......	0 719
								2	0.715	0.787	0.858	0.930	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						24	21.3	1	5686	6319	6952	......	......	......	......	......	......	0.750
								2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						25	22.2	1	5406	6013	......	......	......	......	......	......	......	0.781
								2	0.844	0.929	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
8x14	7½x13½	101.25	1537.74	227.81	26.72	26	23.1	1	5145	......	......	......	......	......	......	......	......	0.813
								2	0.914	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
		1.106	1.189	1.148	1.106	Multiplying Factor		1	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	
								2	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
8x16	7½x15½	116.25	2327.43	300.31	30.68	11	8.5	1	17873	19694	21515	23336	25157	26978	......	......	......	0.344
								2	0.143	0.157	0.171	0.185	0.200	0.214	......	......	......	
								3	152	168	183	199	215	230	......	......	......	
								4	117	129	141	153	164	176	......	......	......	
						12	9.3	1	16322	17991	19660	21329	22998	24667	26336	......	......	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	......	......	
								3	127	141	154	167	180	193	206	......	......	
								4	......	......	......	......	......	......	172	......	......	
		1.101	1.174	1.136	1.101	13	10.1	1	15011	16552	18093	19634	21175	22716	24257	27339	......	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	......	
								3	108	119	130	142	153	164	175	197	......	
								4	......	......	......	......	......	......	......	179	......	
						14	10.8	1	13881	15312	16743	18174	19605	21036	22467	25329	28191	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	93	103	112	122	131	141	151	170	189	
								4	......	......	......	......	......	......	......	......	185	

8x16	7½x15½	116.25 1.101	2327.43 1.174	300.31 1.136	30.68 1.101	15	11.6	1	12890	14225	15560	16895	18230	19565	20900	23570	26240	0.469
								2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	
								3	81	89	97	106	114	122	131	147	164	
						16	12.4	1	12019	13270	14521	15772	17023	18274	19525	22027	24529	0.500
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	
								3	70	78	85	92	100	107	114	129	144	
						17	13.2	1	11268	12447	13626	14805	15984	17163	18342	20700	23058	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	62	69	75	82	88	95	101	114	127	
						18	13.9	1	10575	11688	12801	13914	15027	16140	17253	19479	21705	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	55	61	67	72	78	84	90	101	113	
						19	14.7	1	9957	11011	12065	13119	14173	15227	16281	18389	20497	0.594
								2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	49	54	60	65	70	75	80	91	101	
						20	15.5	1	9397	10398	11399	12400	13401	14402	15403	17405	19407	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	44	49	53	58	63	67	72	82	91	
						21	16.3	1	8895	9849	10803	11757	12711	13665	14618	16526	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	40	44	48	53	57	61	65	74	......	
						22	17.0	1	8427	9337	10247	11158	12068	12978	13888	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	36	40	44	48	51	55	59	......	......	
						23	17.8	1	8002	8873	9744	10614	11485	12356	13227	......	......	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	......	......	
								3	33	36	40	43	47	50	54	......	......	
						24	18.6	1	7609	8444	9278	10113	10947	......	......	......	......	0.750
								2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	30	33	36	40	43	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot Based on Green Timber at 38 lbs. per cu. ft.	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						25	19.4	1 2 3	7247 0.737 27	8048 0.811 30	8850 0.884 33	9651 0.958 36	....	....	....	....	....	0.781
						26	20.1	1 2 3	6905 0.796 25	7675 0.876 28	8446 0.956 30	....	....	....	....	....	....	0.813
8x16	7½x15½	116.25 1.101	2327.43 1.174	300.31 1.136	30.68 1.101	27	20.9	1 2 3	6592 0.859 23	7334 0.945 25	....	....	....	....	....	....	....	0.844
						28	21.7	1 2 3	6293 0.923 21	....	....	....	....	....	....	....	....	0.875
						Multiplying Factor		1 2 4	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	1.14 0.97 1.03	
						12	8.2	1 2 3 4	20854 0.150 145 122	22981 0.165 160 134	25108 0.180 174 146	27235 0.195 189 158	29362 0.210 204 170	31489 0.225 219 182	....	....	....	0.375

8x18	7½x17½	131.25 1.097	3349.61 1.161	382.81 1.129	34.63 1.097	13	8.9	1	19170	21132	23094	25056	27018	28980	30942	.....	.....	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	.....	.....	
								3	123	135	148	161	173	186	198	.....	.....	
								4	.....	.....	.....	.....	.....	.....	180	.....	.....	
						14	9.6	1	17745	19568	21391	23214	25037	26860	28683	.....	.....	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	.....	.....	
								3	106	117	127	138	149	160	171	.....	.....	
						15	10.3	1	16490	18191	19892	21593	23294	24995	26696	30098	.....	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	.....	
								3	92	101	110	120	129	139	148	167	.....	
								4	.....	.....	.....	.....	.....	.....	.....	175	.....	
						16	11.0	1	15396	16991	18586	20181	21776	23371	24966	28156	31346	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	80	89	97	105	113	122	130	147	163	
								4	.....	.....	.....	.....	.....	.....	.....	.....	182	
						17	11.7	1	14421	15922	17423	18924	20425	21926	23427	26429	29431	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	71	78	85	93	100	108	115	130	144	
						18	12.3	1	13556	14974	16392	17810	19228	20646	22064	24900	27736	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	63	69	76	82	89	96	102	115	128	
						19	13.0	1	12782	14126	15470	16814	18158	19502	20846	23534	26222	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	56	62	68	74	80	86	91	103	115	
						20	13.7	1	12067	13343	14619	15895	17171	18447	19723	22275	24827	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	50	56	61	66	72	77	82	93	103	
						21	14.4	1	11423	12638	13853	15068	16283	17498	18713	21143	23573	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	45	50	55	60	65	69	74	84	94	
						22	15.1	1	10838	11998	13118	14318	15478	16638	17798	20118	.....	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	.....	
								3	41	45	50	54	59	63	67	76	.....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						23	15.8	1	10305	11415	12525	13635	14745	15855	16965	19185	......	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	......	
								3	37	41	45	49	53	57	62	70	......	
						24	16.5	1	9809	10873	11937	13001	14065	15129	16193	......	......	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	......	......	
								3	34	38	41	45	49	53	56	......	......	
						25	17.1	1	9344	10365	11386	12407	13428	14449	......	......	......	0 781
								2	0.652	0.718	0.783	0.848	0.914	0.979	......	......	......	
								3	31	35	38	41	45	48	......	......	......	
8x18	7½x17½	131.25	3349.61	382.81	34.63	26	17.8	1	8917	9899	10881	11862	12844	......	......	......	......	0.813
								2	0.705	0.775	0.846	0.917	0.987	......	......	......	......	
		1 097	1.161	1.129	1.097			3	29	32	35	38	41	......	......	......	......	
						27	18.5	1	8515	9460	10405	11350	......	......	......	......	......	0.844
								2	0.761	0.837	0.913	0.989	......	......	......	......	......	
								3	26	29	32	35	......	......	......	......	......	
						28	19.2	1	8145	9057	9968	......	......	......	......	......	......	0.875
								2	0.818	0.900	0.982	......	......	......	......	......	......	
								3	24	27	30	......	......	......	......	......	......	
						29	19.9	1	7795	8675	......	......	......	......	......	......	......	0.906
								2	0.877	0.965	......	......	......	......	......	......	......	
								3	22	25	......	......	......	......	......	......	......	

						30	20.6	1	7468	....	..				.			0.938
								2	0.939	......	......	......	......	......	......	......	......	
								3	21	......	.....	.....	.....	....	.	.	.....	
						Multiplying Factor		1	**1.13**	**1.13**	**1 13**	**1.13**	**1.13**	**1.13**	**1.13**	**1.13**	**1.13**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0 97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1 03**	**1.03**	**1.03**	
						14	8.6	1	22090	24353	26616	28879	31142	33405	......	......	.....	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	......	......	......	
								3	118	130	143	155	167	179	...	...	...	
								4	116	128	139	151	163	174	......	......	....	
						15	9.2	1	20542	22654	24766	26878	28990	31102	33214	..		0.469
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	......	......	
								3	103	113	124	134	145	156	166	...		
								4	......	......	......	......	......	......	173	......	.....	
						16	9.8	1	19193	21174	23155	25136	27117	29098	31079	35041	..	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	......	
								3	90	99	109	118	127	136	146	164	.....	
								4	......	......	......	.....	.....	.....	......	183	..	
8x20	7½x19½	146.25	4634.30	475.31	38.58	17	10 5	1	17985	19849	21713	23577	25441	27305	29169	32897	.....	0.531
		1.094	1.150	1.121	1.094			2	0.271	0.298	0.324	0.352	0 379	0.406	0.433	0.487	.	
								3	79	88	96	104	112	121	129	145	.....	
						18	11.1	1	.16916	18677	20438	22199	23960	25721	27482	31004	34526	0.563
								2	0.304	0.334	0.364	0 395	0 425	0.455	0.486	0.547	0.607	
								3	71	78	85	93	100	108	114	129	144	
								4	......	......	......	......	......	......	......	......	181	
	...					19	11.7	1	15947	17615	19283	20951	22619	24287	25955	29291	32627	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	63	70	76	83	89	96	102	116	129	
						20	12.3	1	15079	16664	18249	19834	21419	23004	24589	27759	30929	0.625
								2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	57	63	68	74	80	86	92	104	116	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
								1	14280	15789	17298	18807	20316	21825	23334	26352	29370	
						21	12.9	2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	0.656
								3	51	56	62	67	73	78	83	94	105	
								1	13562	15003	16444	17885	19326	20767	22208	25090	27972	
						22	13 5	2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	0.688
								3	46	51	56	61	66	71	76	86	95	
								1	12893	14271	15649	17027	18405	19783	21161	23917	26673	
						23	14 2	2	0.496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	0.719
8x20	$7\frac{1}{2}$x$19\frac{1}{2}$	146.25	4634.30	475 31	38 58			3	42	47	51	56	60	64	69	78	87	
		1 094	1 150	1 121	1.094			1	12285	13606	14927	16248	17569	18890	20211	22853	......	
						24	14 8	2	0.539	0 593	0 647	0.701	0.755	0.809	0.863	0.971	......	0.750
								3	38	43	47	51	55	59	63	71	......	
								1	11716	12984	14252	15520	16788	18056	19324	......	......	
						25	15 4	2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	0.781
								3	35	39	43	47	50	54	58	......	......	
								1	11187	12406	13625	14844	16063	17282	......	......	......	
						26	16 0	2	0.633	0.696	0.760	0.824	0.887	0.950	......	......	......	0.813
								3	32	36	39	43	46	50	......	......	......	
								1	10699	11873	13047	14221	15395	......	......	......	......	
						27	16 6	2	0 683	0.752	0 820	0 888	0.956	......	......	......	......	0.844
								3	30	33	36	40	43	......	......	......	......	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

						28	17.2	1	10240	11372	12504	13636	.....	.....	.....	.....	.....	0.875
								2	0.735	0.808	0.882	0.955	.....	.....	.....	.....	.....	
								3	27	30	34	37	.....	.....	.....	.....	.....	
						29	17.8	1	9812	10905	11998	.....	.....	.....	.....	.....	.....	0.906
								2	0.788	0 867	0.946	.....	.....	.....	.....	.....	.....	
								3	25	28	31	.....	.....	.....	.....	.....	.....	
						30	18.5	1	9403	10459	.....	.....	.....	.....	.....	.....	.....	0.938
8x20	7½x19½	146.25	4634.30	475.31	38.58			2	0.843	0.928	.....	.....	.....	.....	.....	.....	.....	
								3	24	26	.....	.....	.....	.....	.....	.....	.....	
		1.094	**1.150**	**1.121**	**1.094**	31	19.1	1	9025	10047	.....	.....	.....	.....	.....	.....	.....	0.969
								2	0.901	0.991	.....	.....	.....	.....	.....	.....	.....	
								3	22	24	.....	.....	.....	.....	.....	.....	.....	
						32	19.7	1	8671	.....	.....	.....	.....	.....	.....	.....	.....	1.000
								2	0.959	.....	.....	.....	.....	.....	.....	.....	.....	
								3	20	.....	.....	.....	.....	.....	.....	.....	.....	
						Multiplying Factor		1	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1 12**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1 03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	
						7	8.8	1	13443	14804	16165	17526	18887	20248	21609	.....	.....	0.219
								2	0.0942	0.104	0.113	0.123	0.132	0.141	0.151	.....	.....	
								3	230	254	277	301	324	347	371	.....	.....	
								4	113	125	136	147	159	170	181	.....	.....	
						8	10.1	1	11719	12910	14101	15292	16483	17674	18865	21247	.....	0.250
								2	0.123	0.135	0.148	0.160	0.172	0.185	0.197	0.222	.....	
10x10	9½x9½	90.25	678.76	142.89	23.81			3	176	194	211	229	247	265	283	319	.....	
		1.108	**1.227**	**1.166**	**1.108**			4	.....	.....	.....	.....	.....	.....	.....	178	.....	
						9	11.4	1	10366	11424	12482	13540	14598	15656	16714	18830	20946	0.281
								2	0.156	0.171	0.187	0.203	0.218	0.234	0.249	0.281	0.312	
								3	138	152	166	181	195	209	223	251	279	
								4	.....	.....	.....	.....	.....	.....	.....	.....	176	
						10	12.6	1	9282	10234	11186	12138	13090	14042	14994	16898	18802	0.313
								2	0.192	0.212	0.231	0.250	0.269	0.289	0.308	0.346	0.385	
								3	111	123	134	146	157	169	180	203	226	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
						11	13.9	1	8396	9262	10128	10993	11859	12725	13591	15322	17054	0.344
								2	0.233	0.256	0.279	0.302	0.326	0.349	0.372	0 419	0.465	
								3	92	101	111	120	129	139	148	167	186	
						12	15.2	1	7649	8443	9236	10030	10823	11617	12410	13997	15584	0.375
								2	0.277	0.305	0.332	0.360	0.388	0.415	0.443	0.499	0.554	
								3	76	84	92	100	108	116	124	140	156	
						13	16.4	1	7013	7745	8478	9210	9942	10675	11407	12871	14336	0.406
								2	0 325	0.357	0.390	0.422	0 455	0.487	0.520	0 585	0.650	
10x10	9½x9½	90 25	678.76	142.89	23.81			3	65	72	78	85	92	99	105	119	132	
						14	17.7	1	6469	7149	7829	8510	9190	9870	10550	11911	13271	0.438
		1 108	1.227	1 166	1 108			2	0 377	0.415	0.452	0.490	0.528	0.565	0.603	0.678	0.754	
								3	55	61	67	73	79	85	90	102	114	
						15	19.0	1	5991	6626	7261	7895	8530	9165	9800	11069	12339	0.469
								2	0.433	0.476	0.519	0.563	0.606	0.649	0.693	0.779	0.866	
								3	48	53	58	63	68	73	78	89	99	
						16	20.2	1	5570	6165	6760	7355	7950	8546	9141	10331	11521	0.500
								2	0.492	0.542	0.591	0.640	0 689	0.738	0.788	0.886	0.985	
								3	42	46	51	55	60	64	69	78	86	
						17	21.5	1	5196	5756	6316	6876	7436	7997	8557	......	......	0.531
								2	0.556	0.612	0.667	0.723	0.778	0.834	0.890	......	......	
								3	37	41	45	49	52	56	60	......	......	

						18	22.7	1	4861	5390	5919	6448	6977	7506	8035	......	....	0.563
								2	0 623	0 686	0.748	0 810	0.873	0 935	0 997	...	....	
								3	32	36	39	43	46	50	54	..	...	
						19	24.0	1	4560	5061	5562	6064	6565	......	......	......	.....	0.594
								2	0.694	0.764	0.833	0.902	0.972	......	......	......	......	
								3	29	32	35	38	41	......	......	...	....	
						Multiplying Factor		1	1 17	1.17	1 17	1 17	1 17	1.17	1.17	1.17	1 17	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0 95	
								4	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
						8	8.3	1	17229	18975	20721	22467	24213	25959	......	......	......	0.250
								2	0.102	0.112	0.122	0.132	0.142	0.153	......	......	......	
								3	215	237	259	281	303	325	......	......	......	
								4	120	132	144	156	168	180	...	......	.....	
						9	9.4	1	15250	16801	18352	19903	21454	23005	24556	......	......	0.281
								2	0.129	0.142	0.155	0.167	0.180	0.193	0.206	......	......	
								3	169	187	204	221	238	256	273	......	.....	
								4	......	......	......	......	......	......	170	......	......	
						10	10.4	1	13672	15068	16464	17860	19256	20652	22048	24840	......	0.313
								2	0.159	0.175	0.191	0.207	0.222	0.238	0.254	0.286	......	
								3	137	151	165	179	193	207	220	248	.....	
10x12	9½x11½	109.25	1204.03	209.40	28.83			4	......	......	......	......	......	......	......	173	......	
		1.098	1.196	1.145	1.098	11	11.5	1	12383	13653	14923	16193	17463	18733	20003	22543	25083	0.344
								2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0 346	0.384	
								3	113	124	136	147	159	170	182	205	228	
								4	......	......	......	......	......	......	......	......	174	
						12	12.5	1	11294	12458	13622	14786	15950	17114	18278	20606	22934	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	94	104	114	123	133	143	152	172	191	
						13	13.6	1	10365	11439	12513	13587	14661	15735	16809	18957	21105	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	80	88	96	104	113	121	129	146	162	
						14	14.6	1	9571	10569	11566	12564	13561	14559	15556	17551	19546	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0.498	0.561	0.623	
								3	68	75	83	90	97	104	111	125	140	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						15	15 7	1	8875	9806	10737	11667	12598	13529	14460	16321	18183	0.469
								2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	
								3	59	65	72	78	84	90	96	109	121	
						16	16.7	1	8264	9137	10009	10882	11754	12627	13499	15244	16989	0.500
								2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	52	57	63	68	73	79	84	95	106	
						17	17.7	1	7728	8550	9372	10193	11015	11837	12659	14302	15946	0.531
								2	0.459	0.505	0.551	0.597	0.643	0.688	0.734	0.826	0.918	
10x12	9½x11½	109.25	1204.03	209.40	28.83			3	45	50	55	60	65	70	75	84	94	
		1.098	1.196	1.145	1 098	18	18.8	1	7241	8017	8793	9569	10345	11121	11897	13449	......	0.563
								2	0.515	0.566	0.618	0.670	0.721	0.773	0.824	0.927	......	
								3	40	45	49	53	57	62	66	75	......	
						19	19.8	1	6802	7537	8272	9007	9742	10477	11212	......	......	0.594
								2	0.573	0.631	0.688	0.745	0.802	0.860	0.917	......	......	
								3	36	40	44	47	51	55	59	......	......	
						20	20.9	1	6403	7101	7799	8497	9195	9893	......	......	......	0.625
								2	0 635	0.699	0.762	0.826	0.889	0.953	......	......	......	
								3	32	36	39	42	46	49	......	......	......	
						21	21.9	1	6044	6709	7374	8039	8704	......	......	......	......	0.656
								2	0.701	0.771	0.841	0.911	0 981	......	......	......	......	
								3	29	32	35	38	41	......	......	......	......	

						22	23.0	1	5713	6348	6983	7617	......	......	......	......	......	0.688
								2	0 769	0.846	0.923	1.000	......	......	......	......	......	
								3	26	29	32	35	......	......	......	......	......	
						23	24.0	1	5408	6015	......	......	......	......	......	......	......	0.719
								2	0.841	0.925	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
						Multiplying Factor		1	1 15	1.15	1 15	1.15	1.15	1 15	1.15	1 15	1.15	
								2	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
						9	8.0	1	21065	23202	25339	27476	29613	......	......	......	......	0 281
								2	0 110	0.121	0.131	0.142	0 153	......	......	......	......	
								3	201	221	241	262	282	......	......	......	......	
								4	125	138	150	163	175	......	......	......	......	
						10	8.9	1	18891	20814	22737	24660	26583	28506	30429	......	......	0.313
								2	0.135	0.149	0.162	0.176	0.189	0.203	0.216	......	......	
								3	162	178	195	211	228	244	261	......	......	
								4	......	......	......	......	......	169	180	......	......	
						11	9.8	1	17108	18856	20604	22352	24100	25848	27596	31092	......	0.344
								2	0.164	0.180	0.196	0.213	0.229	0.245	0.262	0.295	......	
								3	133	147	161	174	188	202	215	242	......	
10x14	9½x13½	128.25	1947.80	288.56	33.85			4	......	......	......	......	......	......	......	184	......	
		1.091	1.174	1.132	1.091	12	10.7	1	15624	17227	18830	20433	22036	23639	25242	28448	......	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0.311	0.350	......	
								3	112	123	134	146	157	169	180	203	......	
						13	11.6	1	14360	15840	17320	18800	20280	21760	23240	26200	29160	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.306	0.412	0.457	
								3	95	104	114	124	134	143	153	173	192	
								4	......	......	......	......	......	......	......	......	173	
						14	12.4	1	13266	14640	16014	17388	18762	20136	21510	24258	27006	0.438
								2	0.265	0.292	0.318	0.344	0.371	0.397	0.424	0.477	0.530	
								3	81	90	98	106	115	123	132	149	166	
						15	13.3	1	12312	13594	14876	16158	17440	18722	20004	22568	25132	0.469
								2	0.304	0.334	0.365	0.395	0.426	0.456	0.486	0.547	0.608	
								3	70	78	85	92	100	107	114	129	144	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						16	14.2	1	11478	12680	13882	15084	16286	17488	18690	21094	23498	0.500
								2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0.692	
								3	62	68	74	81	87	94	100	113	126	
						17	15.1	1	10735	11866	12997	14128	15259	16380	17521	19783	22045	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	
								3	54	60	66	71	77	83	88	100	111	
						18	16.0	1	10081	11150	12219	13288	14357	15426	16495	18633	20771	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	48	53	58	63	68	73	79	89	99	
10x14	9½x13½	128.25	1947.80	288.56	33.85	19	16.9	1	9477	10489	11501	12513	13525	14537	15549	17573	19597	0.594
		1.091	1.174	1.132	1.091			2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	43	47	52	56	61	66	70	79	88	
						20	17.8	1	8942	9904	10866	11828	12790	13752	14713	16637	......	0.625
								2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	......	
								3	38	42	47	51	55	59	63	71	......	
						21	18.7	1	8449	9365	10281	11197	12113	13029	13945	......	......	0.656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	
								3	34	38	42	46	49	53	57	......	......	
						22	19.6	1	7995	8869	9743	10617	11491	12365	......	......	......	0.688
								2	0.654	0.719	0.785	0.850	0.915	0.981	......	......	......	
								3	31	35	38	41	45	48	......	......	......	

10x14	9½x13½	128.25	1947.80	288.56	33.85	23	20 4	1	7581	8417	9253	10089	......	......	......	......	......	0.719
		1 091	1 174	1 132	1 091			2	0 715	0 787	0.858	0.930	......	......	......	......	......	
								3	28	31	34	38	......	......	......	......	......	
						24	21.3	1	7205	8007	8808	......	......	......	......	......	......	0.750
								2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	26	29	31	......	......	......	......	......	......	
						25	22.2	1	6848	7617	......	......	......	......	......	......	......	0 781
								2	0.844	0.929	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						26	23.1	1	6519	......	......	......	......	......	......	......	......	0 813
								2	0 914	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.13	1.13	1 13	1.13	1.13	1 13	1 13	1 13	1 13	
								2	0.96	0 96	0.96	0.96	0.96	0.96	0.96	0 96	0 96	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1 04	1.04	1.04	
10x16	9½x15½	147.25	2948.07	380.40	38.88	11	8.5	1	22632	24938	27244	29550	31856	34162	......	......	......	0.344
		1.086	1.158	1.122	1.086			2	0.143	0.157	0.171	0.185	0.200	0.214	......	......	......	
								3	154	170	186	201	217	233	......	......	......	
								4	117	129	141	153	164	176	......	......	......	
						12	9.3	1	20653	22765	24877	26989	29101	31213	33325	......	......	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	......	......	
								3	129	142	156	169	182	195	208	......	......	
								4	......	......	......	......	......	......	172	......	......	
						13	10.1	1	19005	20956	22907	24858	26809	28760	30711	34613	......	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	......	
								3	110	121	132	143	155	166	177	200	......	
								4	......	......	......	......	......	......	......	179	......	
						14	10.8	1	17576	19388	21200	23012	24824	26636	28448	32072	35696	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	94	104	114	123	133	143	152	172	191	
								4	......	......	......	......	......	......	......	......	185	
						15	11.6	1	16327	18018	19709	21400	23091	24782	26473	29855	33237	0.469
								2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	
								3	82	90	99	107	115	124	132	149	166	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						16	12.4	1	15228	16813	18398	19983	21568	23153	24738	27908	31078	0.500
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	
								3	71	79	86	94	101	108	116	131	146	
						17	13 2	1	14259	15751	17243	18735	20227	21719	23211	26195	29179	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	63	69	76	83	89	96	102	116	129	
						18	13 9	1	13390	14799	16208	17617	19026	20435	21844	24662	27480	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	56	62	68	73	79	85	91	103	114	
10x16	9½x15½	147 25	2948 07	380 40	38 88	19	14 7	1	12611	13946	15281	16616	17951	19286	20621	23291	25961	0.594
		1 086	1 158	1.122	1.086			2	0 425	0 468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	50	55	60	66	71	76	81	92	102	
						20	15.5	1	11913	13182	14451	15720	16989	18258	19527	22065	24603	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	45	49	54	59	64	69	73	83	92	
						21	16.3	1	11264	12472	13680	14888	16096	17304	18512	20928	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	40	45	49	53	58	62	66	75	......	
						22	17 0	1	10675	11828	12981	14134	15287	16440	17593	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	36	40	44	48	52	56	60	......	......	

						23	17.8	1	10136	11239	12342	13445	14548	15651	16754	......	......	0.719
								2	0.623	0 686	0.748	0.810	0.872	0.935	0 997	......	......	
								3	33	37	40	44	47	51	55	......	......	
						24	18 6	1	9627	10683	11739	12795	13851	......	......	......	......	0.750
								2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	30	33	37	40	43	......	......	......	......	
						25	19.4	1	9178	10193	11208	12223	......	......	......	......	......	0.781
								2	0.737	0.811	0.884	0.958	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
10x16	9½x15½	147.25	2948 07	380.40	38.88	26	20.1	1	8747	9723	10699	......	......	......	......	......	......	0.813
		1.086	1.158	1.122	1.086			2	0.796	0 876	0.956	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						27	20.9	1	8345	9285	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						28	21.7	1	7971	......	......	......	......	......	......	......	......	0.875
								2	0.923	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1 03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						12	8.2	1	26393	29085	31777	34469	37161	39853	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	147	162	177	192	206	221	......	......	......	
								4	122	134	146	158	170	182	......	......	......	
10x18	9½x17½	166.25	4242.84	484.90	43 89	13	8.9	1	24289	26775	29261	31747	34233	36719	39205	......	......	0.406
		1.083	1.145	1.114	1.083			2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	125	137	150	163	176	188	201	......	......	
								4	......	......	......	......	......	......	180	......	......	
						14	9.6	1	22476	24785	27094	29403	31712	34021	36330	......	......	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
								3	107	118	129	140	151	162	173	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued. For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						15	10.3	1	20872	23025	25178	27331	29484	31637	33790	38096	......	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	......	
								3	93	102	112	121	131	141	150	169	......	
								4	......	......	......	......	......	......	......	175	......	
						16	11.0	1	19498	21518	23538	25558	27578	29598	31618	35658	39698	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	81	90	98	107	115	123	132	149	165	
								4	......	......	......	......	......	......	......	......	182	
10x18	9½x17½	166 25	4242 84	484 90	43 89	17	11 7	1	18264	20165	22066	23967	25868	27769	29670	33472	37274	0.531
		1 083	1.145	1.114	1.083			2	0 301	0.332	0.362	0.392	0.422	0 452	0.482	0.543	0.603	
								3	72	79	87	94	101	109	116	131	146	
						18	12.3	1	17160	18955	20750	22545	24340	26135	27930	31520	35110	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	64	70	77	84	90	97	103	117	130	
						19	13.0	1	16176	17877	19578	21279	22980	24681	26382	29784	33186	0.594
								2	0.377	0.414	0 452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	57	63	69	75	81	87	93	104	116	
						20	13.7	1	15282	16898	18514	20130	21746	23362	24978	28210	31442	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	51	56	62	67	73	78	83	94	105	

						21	14.4	1	14469	16008	17547	19086	20625	22164	23703	26781	29859	
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	0.656
								3	46	51	56	61	66	70	75	85	95	
						22	15.1	1	13725	15194	16663	18132	19601	21070	22539	25477	....	
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	....	0.688
								3	42	46	51	55	59	64	68	77	....	
						23	15.8	1	13041	14446	15851	17256	18661	20066	21471	24281	....	
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	....	0.719
								3	38	42	46	50	54	58	62	70	....	
						24	16.5	1	12407	13753	15099	16445	17791	19137	20483	....	....	
								2	0.261	0.661	0.721	0.781	0.841	0.901	0.961	....	....	0.750
								3	34	38	42	46	49	53	57	....	....	
						25	17.1	1	11833	13126	14419	15712	17005	18298	....	....	....	
								2	0.652	0.718	0.783	0.848	0.914	0.979	....	....	....	0.781
								3	32	35	38	42	45	49	....	....	....	
10x18	9½x17½	166.25	4242.84	484.90	43.89	26	17.8	1	11289	12532	13775	15018	16261	....	....	....	....	
		1.083	1.145	1.114	1.083			2	0.705	0.775	0.846	0.917	0.987	....	....	....	....	0.813
								3	29	32	35	38	42	....	....	....	....	
						27	18.5	1	10785	11982	13179	14376	....	....	....	....	....	
								2	0.761	0.837	0.913	0.989	....	....	....	....	....	0.844
								3	27	30	33	36	....	....	....	....	....	
						28	19.2	1	10311	11465	12619	....	....	....	....	....	....	
								2	0.818	0.900	0.982	....	....	....	....	....	....	0.875
								3	25	27	30	....	....	....	....	....	....	
						29	19.9	1	9867	10981	....	....	....	....	....	....	....	
								2	0.877	0.965	....	....	....	....	....	....	....	0.906
								3	23	25	....	....	....	....	....	....	....	
						30	20.6	1	9453	....	....	....	....	....	....	....	....	
								2	0.939	....	....	....	....	....	....	....	....	0.938
								3	21	....	....	....	....	....	....	....	....	
						Multiplying Factor		1	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
									Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						14	8.6	1	27995	30863	33731	36599	39467	42335	...	...	...	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	...	...	...	
								3	120	132	145	157	169	181	...	...	...	
								4	116	128	139	151	163	174	...	...	...	
						15	9.2	1	26027	28703	31379	34055	36731	39407	42083	...	...	0.469
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	...	...	
								3	104	115	126	136	147	158	168	...	...	
								4	...	...	...	...	...	...	173	...	...	
10x20	9½x19½	185.25	5870.11	602.06	48.90	16	9.8	1	24308	26817	29326	31835	34344	36853	39362	44380	...	0.500
		1.079	1.135	1.107	1.079			2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	...	
								3	91	101	110	119	129	138	148	167	...	
								4	...	...	...	...	...	...	...	183	...	
						17	10.5	1	22779	25140	27501	29862	32223	34584	36945	41667	...	0.531
								2	0.271	0.298	0.324	0.352	0.379	0.406	0.433	0.487	...	
								3	80	89	97	105	114	122	130	147	...	
						18	11.1	1	21420	23650	25880	28110	30340	32570	34800	39260	43720	0.563
								2	0.304	0.334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	71	79	86	94	101	109	116	131	146	
								4	...	...	...	...	...	...	...	...	181	
						19	11.7	1	20181	22292	24403	26514	28625	30736	32847	37069	41291	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.597	0.541	0.609	0.676	
								3	64	70	77	84	90	97	104	117	130	

10x20	9½x19½	185.25	5870.11	602.06	48.90	20	12.3	1	19102	21110	23118	25126	27134	29142	31150	35166	39182	0.625
		1.079	1.135	1.107	1.079			2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	57	63	69	75	82	88	93	105	118	
						21	12.9	1	18083	19994	21905	23816	25727	27638	29549	33371	37193	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	
								3	52	57	63	68	74	79	84	95	106	
						22	13.5	1	17174	18999	20824	22649	24474	26299	28124	31774	35424	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	47	52	57	62	67	72	77	87	97	
						23	14.2	1	16325	18070	19815	21560	23305	25050	26795	30285	33775	0.719
								2	0.496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	
								3	43	47	52	56	61	65	70	79	88	
						24	14.8	1	15546	17218	18890	20562	22234	23906	25578	28922	......	0.750
								2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	......	
								3	39	43	47	51	56	60	64	72	......	
						25	15.4	1	14837	16443	18049	19655	21261	22867	24473	......	......	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	
								3	36	39	43	47	51	55	59	......	......	
						26	16.0	1	14169	15713	17257	18801	20345	21889	......	......	......	0.813
								2	0.633	0.696	0.760	0.824	0.887	0.950	......	......	......	
								3	33	36	40	43	47	51	......	......	......	
						27	16.6	1	13540	15026	16512	17998	19484	......	......	......	......	0.844
								2	0.683	0.752	0.820	0.888	0.956	......	......	......	......	
								3	30	33	37	40	43	......	......	......	......	
						28	17.2	1	12971	14405	15839	17273	......	......	......	......	......	0.875
								2	0.735	0.808	0.882	0.955	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						29	17.8	1	12422	13806	15190	......	......	......	......	......	......	0.906
								2	0.788	0.867	0.946	......	......	......	......	......	......	
								3	26	29	31	......	......	......	......	......	......	
						30	18.5	1	11913	13251	......	......	......	......	......	......	......	0.938
								2	0.843	0.928	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued. For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
10x20	$9\frac{1}{2}$x$19\frac{1}{2}$	185.25	5870.11	602.06	48.90	31	19.1	1 2 3	11434 0.901 22	12729 0.991 25	....	....	....	....	....	....	....	0.969
						32	19.7	1 2 3	10985 0.959 21	....	....	....	....	....	....	....	....	1.000
		1.079	**1.135**	**1.107**	**1.079**	Multiplying Factor		1 2 4	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	
12x12	$11\frac{1}{2}$x$11\frac{1}{2}$	132.25	1457.51	253.48	34.90	8	8.3	1 2 3 4	20841 0.102 217 120	22953 0.112 239 132	25065 0.122 261 144	27177 0.132 283 156	29289 0.142 305 168	31401 0.153 327 180	....	....	....	0.250
		1.089	**1.185**	**1.136**	**1.089**	9	9.4	1 2 3 4	18466 0.129 171	20344 0.142 188	22222 0.155 206	24100 0.167 223	25978 0.180 241	27856 0.193 258	29734 0.206 275 170	....	....	0.281
						10	10.4	1 2 3 4	16551 0.159 138	18241 0.175 152	19931 0.191 166	21621 0.207 180	23311 0.222 194	25001 0.238 208	26691 0.254 222	30071 0.286 251 173	....	0.313

12x12	11½x11½	132.25	1457.51	253.48	34.90	11	11.5	1	14976	16512	18048	19584	21120	22656	24192	27264	30336	0.344
		1.089	1.185	1.136	1.089			2	0.192	0.211	0.231	0.250	0.269	0.288	0.307	0.346	0.384	
								3	113	125	137	148	160	172	183	207	230	
								4	.....	.	. .	. .	.	.		. .	174	
						12	12.5	1	13671	15080	16489	17898	19307	20716	22125	24943	27761	0.375
								2	0.229	0.252	0.275	0.297	0.320	0.343	0.366	0.412	0.458	
								3	95	105	115	124	134	144	154	173	193	
						13	13.6	1	12546	13846	15146	16446	17746	19046	20346	22946	25546	0.406
								2	0.268	0.295	0.322	0.349	0.376	0.403	0.430	0.483	0.537	
								3	80	89	97	105	114	122	130	147	164	
						14	14.6	1	11581	12788	13995	15202	16409	17616	18823	21237	23651	0.438
								2	0.312	0.343	0.374	0.405	0.436	0.467	0.498	0.561	0.623	
								3	69	76	83	91	98	105	112	126	141	
						15	15.7	1	10738	11864	12990	14116	15242	16368	17494	19746	21998	0.469
								2	0.358	0.393	0.429	0.465	0.500	0.536	0.572	0.643	0.715	
								3	60	66	72	78	85	91	97	110	122	
						16	16.7	1	10002	11058	12114	13170	14226	15282	16338	18450	20562	0.500
								2	0.407	0.447	0.488	0.528	0.569	0.610	0.650	0.732	0.813	
								3	52	58	63	69	74	80	85	96	107	
						17	17.7	1	9347	10341	11335	12329	13323	14317	15311	17299	19287	0.531
								2	0.459	0.505	0.551	0.597	0.643	0.688	0.734	0.826	0.918	
								3	46	51	56	60	65	70	75	85	95	
						18	18.8	1	8760	9699	10638	11576	12515	13454	14393	16270	......	0.563
								2	0.515	0.566	0.618	0.670	0.721	0.773	0.824	0.927	...	
								3	41	45	49	54	58	62	67	75	....	
						19	19.8	1	8234	9124	10013	10903	11793	12683	13571	......	.....	0.594
								2	0.573	0.631	0.688	0.745	0.802	0.860	0.917	......	.....	
								3	36	40	44	48	52	56	60	......	......	
						20	20.9	1	7753	8598	9443	10288	11133	11979	......	.....	. .	0.625
								2	0.635	0.699	0.762	0.826	0.889	0.953	.....	..	. .	
								3	32	36	39	43	46	50	. . ..	. . .	...	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
12x12	11½x11½	132.25	1457.51	253.48	34.90	21	21.9	1	7317	8122	8927	9732	10537	......	......	......	......	0.656
		1.089	1.185	1.136	1.089			2	0.701	0.771	0.841	0.911	0.981	......	......	......	......	
								3	29	32	35	39	42	......	......	......	......	
						22	23.0	1	6912	7680	8448	9216	......	......	......	......	......	0.688
								2	0.769	0.846	0.923	1.000	......	......	......	......	......	
								3	26	29	32	35	......	......	......	......	......	
						23	24.0	1	6547	7282	......	......	......	......	......	......	......	0.719
								2	0.841	0.925	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
						Multiplying Factor		1	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	**1.14**	
								2	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	
								4	**1.04**	**1 04**	**1 04**	**1.04**	**1.04**	**1.04**	**1 04**	**1.04**	**1.04**	
12x14	11½x13½	155.25	2357.86	349.31	40.97	9	8.0	1	25521	28110	30699	33288	35877	......	......	......	......	0.281
		1 082	1.164	1.122	1 082			2	0.110	0.121	0.131	0 142	0.153	......	......	......	......	
								3	203	223	244	264	285	......	......	......	......	
								4	125	138	150	163	175	......	......	......	......	
						10	8.9	1	22880	25209	27538	29867	32196	34525	36854	......	......	0.313
								2	0.135	0.149	0.162	0 176	0.189	0.203	0.216	......	......	
								3	164	180	197	213	230	247	263	......	......	
								4	......	......	......	......	......	169	180	......	......	

						11	9.8	1	20719	22836	24953	27070	29187	31304	33421	37655	. . .	0.344
								2	0.164	0 180	0.196	0.213	0.229	0.245	0 262	0.295		
								3	135	148	162	176	190	203	217	245	.	
								4	. . . .	. .	. . . . .	. . .	. . . . .	. .		184	.	
						12	10.7	1	18918	20859	22800	24741	26682	28623	30564	34446	. .	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0 311	0.350	. . .	
								3	113	124	136	147	159	170	182	205	. . . . .	
						13	11.6	1	17378	19169	20960	22751	24542	26333	28124	31706	35288	0.406
								2	0.228	0.251	0.274	0.297	0.320	0.343	0.366	0.412	0.457	
								3	95	105	115	125	135	145	155	174	194	
								4	. . . . .	. . . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	173	
						14	12.4	1	16067	17731	19395	21059	22723	24387	26051	29379	32707	0.438
								2	0.265	0.292	0 318	0.344	0 371	0.397	0.424	0 477	0 530	
								3	82	90	99	107	116	124	133	150	167	
						15	13.3	1	14916	16469	18022	19575	21128	22681	24234	27340	30446	0.469
								2	0.304	0.334	0.365	0.395	0.426	0.456	0.486	0.547	0 608	
12x14	11½x13½	155.25	2357.86	349.31	40.97			3	71	78	86	93	101	108	115	130	145	
		1.082	1.164	1.122	1.082	16	14.2	1	13895	15350	16805	18260	19715	21170	22625	25535	28445	0.500
								2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0 692	
								3	62	69	75	82	88	95	101	114	127	
						17	15.1	1	13004	14374	15744	17114	18484	19854	21224	23964	26704	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	
								3	55	60	66	72	78	83	89	101	112	
						18	16.0	1	12203	13497	14791	16085	17379	18673	19967	22555	25143	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	48	54	59	64	69	74	79	90	100	
						19	16.9	1	11472	12697	13922	15147	16372	17597	18822	21272	23722	0.594
								2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	43	48	52	57	62	66	71	80	89	
						20	17.8	1	10821	11985	13149	14313	15477	16641	17805	20133	. . . . . .	0.625
								2	0.541	0.595	0.649	0 703	0.757	0.811	0.865	0.973	. . . . . .	
								3	39	43	47	51	55	59	64	72	. .	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						21	18.7	1	10230	11339	12448	13557	14666	15775	16884	......	......	0.656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	
								3	35	39	42	46	50	54	57	......	......	
						22	19.6	1	9679	10737	11795	12853	13911	14969	......	......	......	0.688
								2	0.654	0.719	0 785	0.850	0 915	0.981	......	......	......	
								3	31	35	38	42	45	49	......	......	......	
						23	20.4	1	9178	10190	11202	12214	......	......	......	......	......	0.719
								2	0.715	0.787	0.858	0.930	......	......	......	......	......	
								3	29	32	35	38	......	......	......	......	......	
12x14	11½x13½	155.25	2357.86	349.31	40.97	24	21.3	1	8719	9689	10659	......	......	......	......	......	......	0.750
		1.082	**1.164**	**1.122**	**1.082**			2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						25	22 2	1	8294	9226	......	......	......	......	......	......	......	0.781
								2	0 844	0.929	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
						26	23.1	1	7894	......	......	......	......	......	......	......	......	0.813
								2	0.914	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	
								2	**0 96**	**0.96**	**0.96**	**0 96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	
								4	**1 04**	**1 04**	**1.04**	**1 04**	**1 04**	**1.04**	**1 04**	**1 04**	**1.04**	

12x16	11½x15½	178.25 1.077	3568.72 1.148	460.48 1.111	47.03 1.077	11	8.5	1	27393	30184	32975	35766	38557	41348	...	...	...	0.344
								2	0.143	0.157	0.171	0.185	0.200	0.214	......	......	......	
								3	156	171	187	203	219	235	...		...	
								4	117	129	141	153	164	176	...	...	...	
						12	9.3	1	25026	27585	30144	32703	35262	37821	40380	...	...	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	......	......	
								3	130	144	157	170	184	197	210	...	...	
								4	......	......	......	......	......	......	172	...	...	
						13	10.1	1	22999	25360	27721	30082	32443	34804	37165	41887	...	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	...	
								3	111	122	133	145	156	167	179	201	...	
								4	......	......	......	......	......	......	......	179	...	
						14	10.8	1	21262	23454	25646	27838	30030	32222	34414	38798	43182	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	95	105	115	124	134	144	154	173	193	
								4	......	......	......	......	......	......	......	......	185	
						15	11.6	1	19764	21811	23858	25905	27952	29999	32046	36140	40234	0.469
								2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	
								3	82	91	99	108	116	125	134	151	168	
						16	12.4	1	18427	20345	22263	24181	26099	28017	29935	33771	37607	0.500
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	
								3	72	80	87	94	102	110	117	132	147	
						17	13.2	1	17251	19056	20861	22666	24471	26276	28081	31691	35301	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	63	70	77	83	90	97	103	117	130	
						18	13.9	1	16203	17908	19613	21318	23023	24728	26433	29843	33253	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	56	62	68	74	80	86	92	104	115	
						19	14.7	1	15266	16882	18498	20114	21730	23346	24962	28194	31426	0.594
								2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	50	56	61	66	72	77	82	93	103	
						20	15.5	1	14409	15944	17479	19014	20549	22084	23619	26689	29759	0.625
								2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	45	50	55	59	64	69	74	83	93	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						21	16.3	1	13632	15094	16556	18018	19480	20942	22404	25328	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	41	45	49	54	58	62	67	75	......	
						22	17.0	1	12915	14310	15705	17100	18495	19890	21285	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	37	41	45	49	53	57	60	......	......	
						23	17.8	1	12268	13603	14938	16273	17608	18943	20278	......	......	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	......	......	
								3	33	37	41	44	48	51	55	......	......	
12x16	11½x15½	178.25	3568.72	460.48	47.03	24	18.6	1	11661	12940	14219	15498	16777	......	......	......	......	0.750
		1.077	**1.148**	**1.111**	**1.077**			2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	30	34	37	40	44	......	......	......	......	
						25	19.4	1	11104	12332	13560	14788	......	......	......	......	......	0.781
								2	0.737	0.811	0.884	0.958	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						26	20.1	1	10587	11768	12949	......	......	......	......	......	......	0.813
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						27	20.9	1	10100	11237	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	

						28	21.7	1 2 3	9643 0.923 22	....	....	....	....	....	....	....	....	0.875
						Multiplying Factor		1 2 4	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1.03	1.11 0.97 1 03	1.11 0.97 1.03	1.11 0.97 1.03	
						12	8.2	1 2 3 4	31973 0.150 148 122	35234 0.165 163 134	38495 0.180 178 146	41756 0.195 193 158	45017 0.210 208 170	48278 0.225 223 182	....	....	....	0.375
						13	8.9	1 2 3 4	29420 0.176 126	32431 0.194 139	35442 0.212 152	38453 0.229 164	41464 0.247 177	44475 0.265 190	47486 0.282 203 180	....	....	0.406
						14	9.6	1 2 3	27227 0.205 108	30024 0.225 119	32821 0.246 130	35618 0.266 141	38415 0.287 153	41212 0.307 164	44009 0.327 175	....	....	0.438
12x18	11½x17½	201.25 1.073	5136.07 1.136	586.98 1.104	53.10 1.073	15	10.3	1 2 3 4	25304 0.235 94	27914 0.258 103	30524 0.282 113	33134 0.305 123	35744 0.329 132	38354 0.352 142	40964 0.376 152	46184 0.423 171 175	....	0.469
						16	11.0	1 2 3 4	23620 0.267 82	26067 0.294 91	28514 0.321 99	30961 0.347 108	33408 0.374 116	35855 0.401 125	38302 0.427 133	43196 0.481 150	48090 0.534 167 182	0.500
						17	11.7	1 2 3	22107 0.301 72	24408 0.332 80	26709 0.362 87	29010 0.392 95	31311 0.422 102	33612 0.452 110	35913 0.482 117	40515 0.543 132	45117 0.603 148	0.531
						18	12.3	1 2 3	20784 0.338 64	22958 0.372 71	25132 0.406 78	27306 0.440 84	29480 0.473 91	31654 0.507 98	33828 0.541 104	38176 0.609 118	42524 0.676 131	0.563
						19	13.0	1 2 3	19591 0.377 57	21651 0.414 63	23711 0.452 69	25771 0.490 75	27831 0.527 81	29891 0.565 87	31951 0.603 93	36071 0.678 105	40191 0.753 118	0.594

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
12x18	$11\frac{1}{2}$x$17\frac{1}{2}$	201 25 1 073	5136 07 1 136	586 98 1 104	53 10 1 073	20	13.7	1	18498	20454	22410	24366	26322	28278	30234	34146	38058	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	51	57	62	68	73	79	84	95	106	
						21	14.4	1	17525	19389	21253	23117	24981	26845	28709	32437	36165	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	46	51	56	61	66	71	76	86	96	
						22	15.1	1	16632	18412	20192	21972	23752	25532	27312	30872	.....	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	.....	
								3	42	47	51	56	60	65	69	78	.....	
						23	15.8	1	15799	17501	19203	20905	22607	24309	26011	29415	.....	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	.....	
								3	38	42	46	51	55	59	63	71	.....	
						24	16.5	1	15036	16667	18298	19929	21560	23191	24822	.....	.....	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	.....	.....	
								3	35	39	42	46	50	54	57	.....	.....	
						25	17.1	1	14332	15898	17464	19030	20596	22162	.....	.....	.....	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	.....	.....	.....	
								3	32	35	39	42	46	49	.....	.....	.....	
						26	17.8	1	13669	15174	16679	18184	19689	.....	.....	.....	.....	0.813
								2	0.705	0.775	0.846	0.917	0.987	.....	.....	.....	.....	
								3	29	32	36	39	42	.....	.....	.....	.....	

						27	18.5	1	13066	14516	15966	17416	....	....	....	....	....	0.844
								2	0.761	0.837	0.913	0.989	....	....	....	....	....	
								3	27	30	33	36	....	....	....	....	....	
						28	19.2	1	12494	13892	15290		....	....	....	....	....	0.875
								2	0.818	0.900	0.982		....	....	....	....	....	
								3	25	28	30	....	....	....	....	....	....	
12x18	11½x17½	201.25	5136.07	586.98	53.10	29	19.9	1	11960	13310	....	....	....	....	....	....	....	0.906
		1.073	1.136	1.104	1.073			2	0.877	0.965	....	....	....	....	....	....	....	
								3	23	26	....	....	....	....	....	....	....	
						30	20.6	1	11456	....	....	....	....	....	....	....	....	0.938
								2	0.939	....	....	....	....	....	....	....	....	
								3	21	....	....	....	....	....	....	....	....	
						Multiplying Factor		1	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						14	8.6	1	33881	37352	40823	44294	47765	51236	....	....	....	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	....	....	....	
								3	121	133	146	158	171	183	....	....	....	
								4	116	128	139	151	163	174	....	....	....	
						15	9.2	1	31512	34752	37992	41232	44472	47712	50952	....	....	0.469
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	....	....	
12x20	11½x19½	224.25	7105.93	728.81	59.19			3	105	116	127	137	148	159	170	....	....	
		1.070	1.126	1.097	1.070			4	....	....	....	....	....	....	173	....	....	
						16	9.8	1	29433	32471	35509	38547	41585	44623	47661	53737	....	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	....	
								3	92	101	111	121	130	140	149	168	....	
								4	....	....	....	....	....	....	....	183	....	
						17	10.5	1	27584	30443	33302	36161	39020	41879	44738	50456	....	0.531
								2	0.271	0.298	0.324	0.352	0.379	0.406	0.433	0.487	....	
								3	81	90	98	106	115	123	132	149	....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						18	11.1	1	25935	28635	31335	34035	36735	39435	42135	47535	52935	0.563
								2	0.304	0.334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	72	80	87	95	102	110	117	132	147	
								4	......	......	......	......	......	......	......	......	181	
						19	11.7	1	24455	27013	29571	32129	34687	37245	39803	44919	50035	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	64	71	78	85	91	98	105	118	132	
12x20	11½x19½	224 25	7105.93	728 81	59 19	20	12.3	1	23116	25546	27976	30406	32836	35266	37696	42556	47416	0.625
		1.070	**1.126**	**1.097**	**1.070**			2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	58	64	70	76	82	88	94	106	119	
						21	12.9	1	21887	24200	26513	28826	31139	33452	35765	40391	45017	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	
								3	52	58	63	69	74	80	85	96	107	
						22	13.5	1	20788	22997	25206	27415	29624	31833	34042	38460	42878	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	47	52	57	62	67	72	77	87	97	
						23	14.2	1	19759	21871	23983	26095	28207	30319	32431	36655	40879	0.719
								2	0.496	0.545	0.595	0.644	0 694	0.743	0.793	0.892	0.991	
								3	43	48	52	57	61	66	71	80	89	

12x20	11½x19½	224.25	7105.93	728.81	59.19	24	14.8	1	18819	20843	22867	24891	26915	28939	30963	35011	......	0.750
		1.070	1.126	1.097	1.070			2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	......	
								3	39	43	48	52	56	60	65	73	......	
						25	15.4	1	17960	19904	21848	23792	25736	27680	29624	......	......	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	
								3	36	40	44	48	52	55	59	......	......	
						26	16.0	1	17151	19020	20889	22758	24627	26496	......	......	......	0.813
								2	0.633	0.696	0.760	0 824	0.887	0.950	......	......	......	
								3	33	37	40	44	47	51	......	......	......	
						27	16.6	1	16401	18201	20001	21801	23601	......	......	......	......	0.844
								2	0.683	0.752	0.820	0.888	0.956	......	......	......	......	
								3	30	34	37	40	44	......	......	......	......	
						28	17.2	1	15703	17439	19175	20911	......	......	......	......	......	0.875
								2	0.735	0.808	0.882	0.955	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						29	17.8	1	15044	16720	18396	......	......	......	......	......	......	0.906
								2	0.788	0.867	0.946	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						30	18.5	1	14424	16044	......	......	......	......	......	......	......	0.938
								2	0.843	0.928	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	
						31	19.1	1	13845	15413	......	......	......	......	......	......	......	0.969
								2	0.901	0.991	......	......	......	......	......	......	......	
								3	22	25	......	......	......	......	......	......	......	
						32	19.7	1	13926	......	......	......	......	......	......	......	......	1.000
								2	0.959	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1 03	1.03	1 03	1.03	1.03	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	$In.^4$	$In.^3$	Lbs.	Ft.												In.
						9	8.0	1	29937	32974	36011	39048	42085	...	...	...	...	0.281
								2	0.110	0.121	0.131	0.142	0.153	...	...	...	...	
								3	204	224	245	266	286	...	...	...	...	
								4	125	138	150	163	175	...	...	...	...	
						10	8.9	1	26839	29571	32303	35035	37767	40499	43231	...	...	0 313
								2	0.135	0.149	0.162	0.176	0.189	0.203	0.216	...	...	
								3	164	181	198	215	231	248	265	...	...	
								4	...	...	...	...	...	...	180	...	...	
						11	9 8	1	24311	26795	29279	31763	34247	36731	39215	44183	...	0.344
14x14	13½x13½	182 25	2767 93	410 06	48 10			2	0 164	0.180	0.196	0.213	0.229	0 245	0.262	0.295	...	
								3	135	149	163	177	191	204	218	246	...	
		1 075	1 156	1 115	1.075			4	...	...	...	...	...	...	...	184	...	
						12	10.7	1	22203	24481	26759	29037	31315	33593	35871	40427	...	0.375
								2	0.195	0.214	0.234	0.253	0.273	0.292	0.311	0.350	...	
								3	113	125	137	148	160	171	183	206	...	
						13	11 6	1	20395	22497	24599	26701	28803	30905	33007	37211	41415	0 406
								2	0.228	0 251	0 274	0 297	0.320	0.343	0.366	0.412	0.457	
								3	96	106	116	126	136	146	155	175	195	
								4	...	...	...	...	...	...	...	...	173	
						14	12 4	1	18847	20799	22751	24703	26655	28607	30559	34463	38367	0.438
								2	0.265	0.292	0.318	0 344	0 371	0 397	0.424	0.477	0.530	
								3	82	91	100	108	117	125	134	151	168	

						15	13.3	1	17488	19309	21130	22951	24772	26593	28414	32056	35698	0.469
								2	0.304	0.334	0.365	0.395	0.426	0.456	0.486	0.547	0.608	
								3	71	79	86	94	101	109	116	131	146	
						16	14.2	1	16311	18019	19727	21435	23143	24851	26559	29975	33391	0.500
								2	0.346	0.381	0.415	0.450	0.484	0.519	0.553	0.623	0.692	
								3	62	69	75	82	89	95	102	115	128	
						17	15.1	1	15262	16870	18478	20086	21694	23302	24910	28126	31342	0.531
								2	0.391	0.430	0.469	0.508	0.547	0.586	0.625	0.703	0.781	
								3	55	61	67	72	78	84	90	101	113	
						18	16.0	1	14324	15843	17362	18881	20400	21919	23438	26476	29514	0.563
								2	0.438	0.482	0.526	0.570	0.613	0.657	0.701	0.789	0.876	
								3	49	54	59	64	69	75	80	90	100	
						19	16.9	1	13476	14915	16354	17793	19232	20671	22110	24988	27866	0.594
								2	0.488	0.537	0.586	0.635	0.684	0.732	0.781	0.879	0.976	
								3	43	48	53	57	62	67	71	80	90	
14x14	13½x13½	182.25	2767.93	410.06	48.10	20	17.8	1	12698	14064	15430	16796	18162	19528	20894	23626	......	0.625
		1.075	**1.156**	**1.115**	**1.075**			2	0.541	0.595	0.649	0.703	0.757	0.811	0.865	0.973	......	
								3	39	43	47	51	56	60	64	72	......	
						21	18.7	1	12000	13301	14602	15903	17204	18505	19806	......	......	0.656
								2	0.596	0.656	0.716	0.775	0.835	0.895	0.954	......	......	
								3	35	39	43	46	50	54	58	......	......	
						22	19.6	1	11362	12604	13846	15088	16330	17572	......	......	......	0.688
								2	0.654	0.719	0.785	0.850	0.915	0.981	......	......	......	
								3	32	35	39	42	45	49	......	......	......	
						23	20.4	1	10774	11962	13150	14338	......	......	......	......	......	0.719
								2	0.715	0.787	0.858	0.930	......	......	......	......	......	
								3	29	32	35	38	......	......	......	......	......	
						24	21.3	1	10236	11375	12514	......	......	......	......	......	......	0.750
								2	0.779	0.857	0.934	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						25	22.2	1	9728	10821	......	......	......	......	......	......	......	0.781
								2	0.844	0.929	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
14x14	13½x13½	182.25	2767.93	410.06	48.10	26	23.1	1	9260	......	......	......	......	......	......	......	......	0.813
								2	0.914	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
		1.075	1.156	1.115	1.075	Multiplying Factor		1	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	
								2	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
								4	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
14x16	13½x15½	209.25	4189.37	540.56	55.20	11	8.5	1	32183	35462	38741	42020	45299	48578	......	......	......	0.344
								2	0.143	0.157	0.171	0.185	0.200	0.214	......	......	......	
								3	157	173	189	205	221	236	......	......	......	
								4	117	129	141	153	164	176	......	......	......	
		1.070	1.141	1.105	1.070	12	9.3	1	29378	32982	35386	38390	41394	44398	47402	......	......	0.375
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271	......	......	
								3	131	147	158	171	185	198	212	......	......	
								4	......	......	......	......	......	......	172	......	......	
						13	10.1	1	27002	29774	32546	35318	38090	40862	43634	49178	......	0.406
								2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358	......	
								3	111	123	134	146	157	168	180	203	......	
								4	......	......	......	......	......	......	......	179	......	
						14	10.8	1	24977	27552	30127	32702	35277	37852	40427	45577	50727	0.438
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	
								3	96	105	115	125	135	145	155	174	194	
								4	......	......	......	......	......	......	......	......	185	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

14x16	13½x15½	209.25 1.070	4189.37 1.141	540.56 1.105	55.20 1.070	15	11.6	1 2 3	23192 0.265 83	25594 0.292 91	27996 0.318 100	30398 0 345 109	32800 0.371 117	35202 0.398 126	37604 0.424 134	42408 0.477 152	47212 0.530 169	0.469
						16	12.4	1 2 3	21637 0.302 72	23889 0.332 80	26141 0.362 88	28393 0.392 95	30645 0 422 103	32897 0 453 110	35149 0.483 118	39653 0.543 133	44157 0.603 148	0.500
						17	13.2	1 2 3	20262 0.341 64	22382 0.375 71	24502 0 409 77	26622 0.443 84	28742 0.477 91	30862 0.511 97	32982 0.545 104	37222 0.613 117	41462 0.681 131	0.531
						18	13.9	1 2 3	19026 0.382 57	21028 0.420 63	23030 0.458 69	25032 0.496 75	27034 0.534 80	29036 0.572 86	31038 0.611 92	35042 0.687 104	39046 0.763 116	0.563
						19	14.7	1 2 3	17921 0.425 51	19818 0.468 56	21715 0.510 61	23612 0.552 67	25509 0.595 72	27406 0.637 77	29303 0.680 83	33097 0.765 93	36891 0.850 104	0.594
						20	15.5	1 2 3	16916 0.471 45	18718 0.518 50	20520 0.565 55	22322 0.612 60	24124 0.659 65	25926 0.706 69	27728 0.754 74	31332 0.848 84	34936 0.942 94	0.625
						21	16.3	1 2 3	16000 0.520 41	17716 0.572 45	19432 0.624 50	21148 0.676 54	22864 0.728 58	24580 0.779 63	26296 0.831 67	29728 0.935 76	....	0.656
						22	17.0	1 2 3	15175 0.570 37	16814 0.627 41	18453 0.684 45	20092 0.741 49	21731 0.798 53	23370 0.855 57	25009 0.912 61	....	....	0.688
						23	17.8	1 2 3	14410 0.623 34	15978 0.686 37	17546 0.748 41	19114 0.810 45	20682 0.872 48	22250 0.935 52	23818 0.997 55	....	....	0.719
						24	18.6	1 2 3	13705 0.679 31	15208 0.746 34	16711 0.814 37	18214 0.882 41	19717 0.950 44	....	....	....	....	0.750
						25	19.4	1 2 3	13040 0.737 28	14482 0.811 31	15924 0.884 34	17366 0.958 37	....	....	....	....	....	0.781

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
14x16	13½x15½	209.25	4189.37	540.56	55.20	26	20.1	1	12425	13811	15197	......	......	......	......	......	......	0.813
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	26	28	31	......	......	......	......	......	......	
						27	20.9	1	11869	13205	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
		1.070	1.141	1.105	1.070	28	21.7	1	11334	......	......	......	......	......	......	......	......	0.875
								2	0.923	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
14x18	13½x17½	236.25	6029.30	689.06	62.33	12	8.2	1	37532	41360	45188	49016	52844	56672	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	149	164	179	195	210	225	......	......	......	
								4	122	134	146	158	170	182	......	......	......	
		1.066	1.128	1.096	1.066	13	8.9	1	34520	38053	41586	45119	48652	52185	55718	......	......	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	127	139	152	165	178	191	204	......	......	
								4	......	......	......	......	......	......	180	......	......	
						14	9.6	1	31938	35219	38500	41781	45062	48343	51624	......	......	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
								3	109	120	131	142	153	164	176	......	......	

The load columns 1000 to 2000 fall under the heading: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated.

						15	10.3	1	29675	32736	35797	38858	41919	44980	48041	54163	.....	0.469
								2	0 235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	.....	
								3	94	104	114	123	133	143	153	172	.....	
								4	.....	.....	.....	.....	.....	.....	.....	175	.....	
						16	11 0	1	27713	30584	33455	36326	39197	42068	44939	50681	56423	0 500
								2	0 267	0.294	0.321	0 347	0.374	0.401	0.427	0.481	0.534	
								3	83	91	100	108	117	125	134	151	168	
								4	.....	.....	.....	.....	.....	.....	.....	.....	182	
						17	11 7	1	25961	28663	31365	34067	36769	39471	42173	47577	52981	0.531
								2	0 301	0 332	0.362	0.392	0.422	0.452	0 482	0.543	0 603	
								3	73	80	88	95	103	111	118	133	148	
						18	12.3	1	24388	26939	29490	32041	34592	37143	39694	44796	49898	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0 541	0.609	0 676	
								3	65	71	78	85	91	98	105	119	132	
14x18	13½x17½	236.25	6029.30	689.06	62.33	19	13.0	1	22996	25414	27832	30250	32668	35086	37504	42340	47176	0.594
		1.066	1.128	1.096	1.066			2	0.377	0.414	0.452	0.490	0.527	0 565	0.603	0.678	0.753	
								3	58	64	70	76	82	88	94	106	118	
						20	13.7	1	21724	24021	26318	28615	30912	33209	35506	40100	44694	0 625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0 834	
								3	52	57	63	68	74	79	85	95	106	
						21	14.4	1	20571	22759	24947	27135	29323	31511	33699	38075	42451	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	47	52	57	62	67	71	75	86	96	
						22	15.1	1	19519	21608	23697	25786	27875	29964	32053	36231	.....	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	.....	
								3	42	47	51	56	60	65	69	78	.....	
						23	15.8	1	18537	20534	22531	24528	26525	28522	30519	34513	.....	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	.....	
								3	38	43	47	51	55	59	63	71	.....	
						24	16.5	1	17644	19558	21472	23386	25300	27214	29128	.....	.....	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0 961	.....	.....	
								3	35	39	43	46	50	54	58	.....	.....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									Deflection equivalent to 1/32 Inch per Foot of Span
Rough	Surfaced S1S1E or S4S	A=bh	I=bh³/12	S=bh²/6			l/h		1000	1100	1200	1300	1400	1500	1600	1800	2000	D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						25	17.1	1	16812	18649	20486	22323	24160	25997	......	......	......	0.781
								2	0.652	0 718	0.783	0.848	0.914	0 979	......	......	......	
								3	32	36	39	43	46	50	......	......	......	
						26	17.8	1	16040	17806	19572	21338	23104	......	......	......	......	0.813
								2	0 705	0.775	0.846	0 917	0.987	......	......	......	......	
								3	29	33	36	39	42	......	......	......	......	
						27	18.5	1	15327	17028	18729	20430	......	......	......	......	......	0.844
								2	0.761	0.837	0.913	0.989	......	......	......	......	......	
								3	27	30	33	36	......	......	......	......	......	
14x18	13½x17½	236.25	6029.30	689.06	62.33	28	19 2	1	14665	16306	17947	......	......	......	......	......	......	0.875
		1.066	1.128	1.096	1.066			2	0.818	0.900	0.982	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						29	19.9	1	14032	15616	......	......	......	......	......	......	......	0.906
								2	0.877	0.965	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						30	20.6	1	13440	......	......	......	......	......	......	......	......	0.938
								2	0.939	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.10	1 10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1 03	1.03	1.03	1.03	

14x20	13½x19½	263.25 1.064	8341.74 1.118	855.56 1.091	69.45 1.064	14	8.6	1	39758	43831	47904	51977	56050	60123	......	......	......	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	......	......	......	
								3	122	134	147	159	172	184	......	......	......	
								4	116	128	139	151	163	174	......	......	......	
						15	9.2	1	36968	40769	44570	48371	52172	55973	59774	......	......	0.469
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	......	......	
								3	106	116	127	138	149	160	171	......	......	
								4	......	......	......	......	......	......	173	......	......	
						16	9.8	1	34509	38071	41633	45195	48757	52319	55881	63005	......	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	......	
								3	92	102	112	121	131	140	150	169	......	
								4	......	......	......	......	......	......	......	183	......	
						17	10.5	1	32349	35702	39055	42408	45761	49114	52467	59173	......	0.531
								2	0.271	0.298	0.324	0.352	0.379	0.406	0.433	0.487	......	
								3	82	90	98	107	115	124	132	149	......	
						18	11.1	1	30440	33609	36778	39947	43116	46285	49454	55792	62130	0.563
								2	0.304	0.331	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	73	80	88	95	103	110	118	133	148	
								4	......	......	......	......	......	......	......	......	181	
						19	11.7	1	28690	31691	34692	37693	40694	43695	46696	52698	58700	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	65	71	78	85	92	99	105	119	132	
						20	12.3	1	27121	29972	32823	35674	38525	41376	44227	49929	55631	0.625
								2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	58	64	70	76	83	89	95	107	119	
						21	12.9	1	25691	28406	31121	33836	36551	39266	41981	47411	52841	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	
								3	52	58	64	69	75	80	86	97	108	
						22	13.5	1	24381	26972	29563	32154	34745	37336	39927	45109	50291	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	48	53	58	63	68	73	78	88	98	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									Deflection equivalent to 1/32 Inch per Foot of Span
Rough	Surfaced S1S1E or S4S	A=bh	I=bh³/12	S=bh²/6			l/h		1000	1100	1200	1300	1400	1500	1600	1800	2000	D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
								1	23202	25682	28162	30642	33122	35602	38082	43042	48002	
						23	14 2	2	0.496	0 545	0 595	0 644	0 694	0.743	0.793	0.892	0.991	0.719
								3	43	48	52	57	62	66	71	80	89	
								1	22103	24480	26857	29234	31611	33988	36365	41119	.....	
						24	14.8	2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	.....	0.750
								3	39	44	48	52	56	61	65	73	.....	
								1	21074	23355	25636	27917	30198	32479	34760	.....	.....	
						25	15.4	2	0.586	0 644	0.703	0 761	0.820	0.878	0.937	.....	.....	0.781
								3	36	40	44	48	52	56	60	.....	.....	
14x20	13½x19½	263.25	8341.74	855 56	69 45			1	20114	22306	24498	26690	28882	31074	.....	.....	.....	
						26	16.0	2	0.633	0.696	0.760	0.824	0.887	0.950	.....	.....	.....	0.813
		1 064	1.118	1 091	1 064			3	33	37	40	44	48	51	.....	.....	.....	
								1	19225	21335	23445	25555	27665	.....	.....	.....	.....	
						27	16 6	2	0 683	0.752	0.820	0.888	0 956	.....	.....	.....	.....	0.844
								3	31	34	37	41	44	.....	.....	.....	.....	
								1	18425	20462	22499	24536	.....	.....	.....	.....	.....	
						28	17.2	2	0.735	0 808	0.882	0 955	.....	.....	.....	.....	.....	0.875
								3	28	31	34	38	.....	.....	.....	.....	.....	
								1	17647	19613	21579		.....	.....	.....	.....	.....	
						29	17 8	2	0.788	0.867	0 946		.....	.....	.....	.....	.....	0.906
								3	26	29	32		.....	.....	.....	.....	.....	

						30	18.5	1	16927	18828								
								2	0.843	0.928								0.938
								3	24	27								
						31	19.1	1	16248	18088								
14x20	13½x19½	263.25	8341.74	855.56	69.45			2	0.901	0.991								0.969
								3	22	25								
		1.064	1.118	1.091	1.064	32	19.7	1	15598									
								2	0.959									1.000
								3	21									
						Multiplying Factor		1	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
						11	8.5	1	36913	40674	44435	48196	51957	55718				
								2	0.143	0.157	0.171	0.185	0.200	0.214				0.344
								3	157	173	189	205	221	237				
								4	117	129	141	153	164	176				
						12	9.3	1	33729	37178	40627	44076	47525	50974	54423			
								2	0.170	0.187	0.204	0.221	0.237	0.254	0.271			0.375
								3	132	145	159	172	186	199	213			
								4							172			
						13	10.1	1	30996	34178	37360	40542	43724	46906	50088	56452		
16x16	15½x15½	240.25	4810.01	620.64	63.40			2	0.199	0.219	0.239	0.259	0.279	0.299	0.318	0.358		0.406
								3	112	123	135	146	158	169	181	204		
		1.065	1.135	1.099	1.065			4								179		
						14	10.8	1	28672	31628	34584	37540	40496	43452	46408	52320	58232	
								2	0.231	0.254	0.277	0.300	0.324	0.347	0.370	0.416	0.462	0.438
								3	96	106	116	126	136	146	155	175	195	
								4									185	
						15	11.6	1	26639	29398	32157	34916	37675	40434	43193	48711	54229	
								2	0.265	0.292	0.318	0.345	0.371	0.398	0.424	0.477	0.530	0.469
								3	83	92	101	109	118	126	135	152	170	
						16	12.4	1	24856	27443	30030	32617	35204	37791	40378	45552	50726	
								2	0.302	0.332	0.362	0.392	0.422	0.453	0.483	0.543	0.603	0.500
								3	73	80	88	96	103	111	118	133	149	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. in.	In.⁴	In.³	Lbs.	Ft.												In.
						17	13.2	1	23252	25685	28118	30551	32984	35417	37850	42716	47582	0.531
								2	0.341	0.375	0.409	0.443	0.477	0.511	0.545	0.613	0.681	
								3	64	71	78	84	91	98	104	118	131	
						18	13.9	1	21849	24148	26447	28746	31045	33344	35643	40241	44839	0.563
								2	0.382	0.420	0.458	0.496	0.534	0.572	0.611	0.687	0.763	
								3	57	63	69	75	81	87	93	105	117	
						19	14.7	1	20585	22764	24943	27122	29301	31480	33659	38017	42375	0.594
								2	0.425	0.468	0.510	0.552	0.595	0.637	0.680	0.765	0.850	
								3	51	56	62	67	72	78	83	94	105	
16x16	15½x15½	240.25	4810.01	620.64	63.40	20	15.5	1	19422	21491	23560	25629	27698	29767	31836	35974	40112	0.625
		1.065	1.135	1.099	1.065			2	0.471	0.518	0.565	0.612	0.659	0.706	0.754	0.848	0.942	
								3	46	50	55	60	65	70	75	84	94	
						21	16.3	1	18379	20350	22321	24292	26263	28234	30205	34147	......	0.656
								2	0.520	0.572	0.624	0.676	0.728	0.779	0.831	0.935	......	
								3	41	45	50	54	59	63	67	76	......	
						22	17.0	1	17415	19296	21177	23058	24939	26820	28701	......	......	0.688
								2	0.570	0.627	0.684	0.741	0.798	0.855	0.912	......	......	
								3	37	41	45	49	53	57	61	......	......	
						23	17.8	1	16532	18331	20130	21929	23728	25527	27326	......	......	0.719
								2	0.623	0.686	0.748	0.810	0.872	0.935	0.997	......	......	
								3	34	37	41	45	48	52	56	......	......	

16x16	15½x15½	240.25 1.065	4810.01 1.135	620.64 1.099	63.40 1.065	24	18.6	1	15718	17442	19166	20890	22014	......	......	......	......	0.750
								2	0.679	0.746	0.814	0.882	0.950	......	......	......	......	
								3	31	34	37	41	44	......	......	......	......	
						25	19.4	1	14965	16620	18275	19930	......	......	......	......	......	0.781
								2	0.737	0.811	0.884	0.958	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						26	20.1	1	14261	15852	17443	......	......	......	......	......	......	0.813
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	26	29	31	......	......	......	......	......	......	
						27	20.9	1	13619	15152	......	......	......	......	......	......	......	0.844
								2	0.859	0.945	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
						28	21.7	1	13005	......	......	......	......	......	......	......	......	0.875
								2	0.923	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	
16x18	15½x17½	271.25 1.061	6922.53 1.123	791.15 1.091	71.58 1.061	12	8.2	1	43081	47475	51869	56263	60657	65051	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	150	165	180	195	211	226	......	......	......	
								4	122	134	146	158	170	182	......	......	......	
						13	8.9	1	39639	43696	47753	51810	55867	59924	63981	......	......	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	127	140	153	166	179	192	205	......	......	
								4	......	......	......	......	......	......	180	......	......	
						14	9.6	1	36668	40435	44202	47969	51736	55503	59270	......	......	0.438
								2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
								3	109	120	132	143	154	165	177	......	......	
						15	10.3	1	34096	37613	41130	44647	48164	51681	55198	62232	......	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	......	
								3	95	105	114	124	134	144	153	173	......	
								4	......	......	......	......	......	......	......	175	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						16	11 0	1	31815	35111	38407	41703	44999	48295	51591	58183	64775	0.500
								2	0.267	0 294	0 321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	83	91	100	109	117	126	134	152	169	
								4	......	......	......	....	......	......	......	......	182	
						17	11 7	1	29793	32894	35995	39096	42197	45238	48399	54601	60803	0.531
								2	0.301	0 332	0.362	0.392	0 422	0 452	0.482	0.543	0.603	
								3	73	81	88	96	103	111	119	134	149	
						18	12.3	1	28011	30941	33871	36801	39731	42661	45591	51451	57311	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
16x18	15½x17½	271.25	6922.53	791.15	71 58			3	65	72	78	85	92	99	106	119	133	
		1.061	1.123	1 091	1 061	19	13.0	1	26400	29176	31952	34728	37504	40280	43056	48608	54160	0.594
								2	0 377	0.414	0 452	0.490	0.527	0.565	0 603	0.678	0.753	
								3	58	64	70	76	82	88	94	107	119	
						20	13.7	1	24939	27576	30213	32850	35487	38124	40761	46035	51309	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	52	57	63	68	74	79	85	96	107	
						21	14 4	1	23607	26118	28629	31140	33651	36162	38673	43695	48717	0.656
								2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	47	52	57	62	67	72	77	87	97	
						22	15.1	1	22405	24803	27201	29599	31997	34395	36793	41589	......	0.688
								2	0 505	0.556	0.606	0.657	0.708	0.758	0.808	0.909	......	
								3	42	47	52	56	61	65	70	79	......	

						23	15.8	1	21274	23566	25858	28150	30442	32734	35026	39610	....	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0 994	....	
								3	39	43	47	51	55	59	63	72	....	
						24	16.5	1	20262	22460	24658	26856	29054	31252	33450	....	....	0 750
								2	0 601	0 661	0.721	0.781	0.841	0.901	0 961	....	....	
								3	35	39	43	47	50	54	58	....	....	
						25	17.1	1	19310	21420	23530	25640	27750	29860	....	....	....	0.781
								2	0.652	0.718	0.783	0 848	0.914	0 979	....	....	....	
								3	32	36	39	43	46	50	....	....	....	
						26	17.8	1	18429	20458	22487	24516	26545	....	....	....	....	0.813
								2	0.705	0.775	0.846	0 917	0 987	....	....	....	....	
								3	30	33	36	39	43	....	....	....	....	
16x18	15½x17½	271.25	6922.53	791.15	71.58	27	18.5	1	17608	19562	21516	23470	....	....	....	....	....	0.844
		1.C61	**1.123**	**1.091**	**1.061**			2	0.761	0.837	0.913	0.989	....	....	....	....	....	
								3	27	30	33	36	....	....	....	....	....	
						28	19.2	1	16836	18720	20604	....	....	....	....	....	....	0.875
								2	0.818	0.900	0.982	....	....	....	....	....	....	
								3	25	28	31	....	....	....	....	....	....	
						29	19.9	1	16115	17934	....	....	....	....	....	....	....	0.906
								2	0.877	0.965	....	....	....	....	....	....	....	
								3	23	26	....	....	....	....	....	....	....	
						30	20.6	1	15432	....	....	....	....	....	....	....	....	0.938
								2	0.939	....	....	....	....	....	....	....	....	
								3	21	....	....	....	....	....	....	....	....	
						Multiplying Factor		1	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	
16x20	15½x19½	302.25	9577.55	982.31	79.80	14	8.6	1	45673	50352	55031	59710	64389	69068	....	....	....	0.438
		1.058	**1.114**	**1.086**	**1.058**			2	0.184	0.202	0.221	0.239	0.257	0.276	....	....	....	
								3	122	135	148	160	173	185	....	....	....	
								4	116	128	139	151	163	174	....	....	....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						15	9.2	1	42483	46851	51219	55587	59955	64323	68691	......	......	0.469
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	......	......	
								3	106	117	128	139	150	161	172	......	......	
								4	......	......	......	......	......	......	173	......	......	
						16	9.8	1	39653	43746	47839	51932	56025	60118	64211	72397	......	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	......	
								3	93	103	112	122	131	141	151	170	......	
								4	......	......	......	......	......	......	......	183	......	
						17	10.5	1	37164	41016	44868	48720	52572	56424	60276	67980	......	0.531
16x20	15½x19½	302.25	9577.55	982.31	79.80			2	0.271	0.298	0.324	0.352	0.379	0.406	0.433	0.487	......	
		1.058	1.114	1.086	1.058			3	82	90	99	108	116	125	133	150	......	
						18	11.1	1	34964	38604	42244	45884	49524	53164	56804	64084	71364	0.563
								2	0.304	0.334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	73	80	88	96	103	111	118	134	149	
								4	......	......	......	......	......	......	......	......	181	
						19	11.7	1	32974	36423	39872	43321	46770	50219	53668	60566	67464	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	65	72	79	85	92	99	106	120	133	
						20	12.3	1	31154	34429	37704	40979	44254	47529	50804	57354	63904	0.625
								2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	58	65	71	77	83	89	95	108	120	

						21	12.9	1	29524	32644	35764	38884	42004	45124	48244	54484	60724	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0 743	0.826	
								3	53	58	64	69	75	81	86	97	108	
						22	13.5	1	28035	31014	33973	36972	39951	42930	45909	51867	57825	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	48	53	58	63	68	73	78	88	99	
						23	14 2	1	26655	29504	32353	35202	38051	40900	43749	49447	55145	0.719
								2	0.496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	
								3	43	48	53	57	62	67	71	81	90	
						24	14.8	1	25385	28115	30845	33575	36305	39035	41765	47225	......	0.750
								2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	......	
								3	40	44	48	52	57	61	65	74	......	
						25	15.4	1	24205	26825	29445	32065	34685	37305	39925	......	......	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	
16x20	15½x19½	302.25	9577.55	982.31	79.80			3	36	40	44	48	52	56	60	......	......	
		1.058	1.114	1.086	1.058	26	16.0	1	23125	25645	28165	30685	33205	35725	......	......	......	0.813
								2	0.633	0.696	0.760	0.824	0.887	0.950	......	......	......	
								3	33	37	41	44	48	52	......	......	......	
						27	16.6	1	22116	24543	26970	29397	31824	......	......	......	......	0.844
								2	0.683	0.752	0.820	0.888	0.956	......	......	......	......	
								3	31	34	37	41	44	......	......	......	......	
						28	17.2	1	21166	23506	25846	28186	......	......	......	......	......	0.875
								2	0.735	0.808	0.882	0.955	......	......	......	......	......	
								3	28	31	35	38	......	......	......	......	......	
						29	17.8	1	20276	22535	24794	......	......	......	......	......	......	0.906
								2	0.788	0.867	0.946	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						30	18.5	1	19437	21620	......	......	......	......	......	......	......	0.938
								2	0.843	0.928	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	
						31	19.1	1	18647	20759	......	......	......	......	......	......	......	0.969
								2	0.901	0.991	......	......	......	......	......	......	......	
								3	23	25	......	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
16x20	15½x19½	302.25	9577.55	982.31	79.80	32	19.7	1	17927	...	...	...	...	...	...	...	...	1.000
								2	0.959	...	...	...	...	...	...	...	...	
								3	21	...	...	...	...	...	...	...	...	
		1.058	1.114	1.086	1.058	Multiplying Factor		1	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
16x22	15½x21½	333.25	12837.07	1194.15	87.90	15	8.4	1	51731	57036	62341	67646	72951	78256	...	...	...	0.469
		1.056	1.106	1.081	1.056			2	0.191	0.210	0.229	0.248	0.268	0.287	...	...	...	
								3	118	130	142	154	166	178	...	...	...	
								4	120	132	143	155	167	179	...	...	...	
						16	8.9	1	48314	53286	58258	63230	68202	73174	78146	...	...	0.500
								2	0.217	0.239	0.261	0.283	0.304	0.326	0.348	...	...	
								3	103	114	124	135	145	156	167	...	...	
								4	...	...	...	...	...	...	179	...	...	
						17	9.5	1	45306	49986	54666	59346	64026	68706	73386	...	...	0.531
								2	0.245	0.270	0.295	0.319	0.344	0.368	0.393	...	...	
								3	91	100	110	119	128	138	147	...	...	
						18	10.0	1	42627	47048	51469	55890	60311	64732	69153	77995	...	0.563
								2	0.275	0.303	0.330	0.358	0.386	0.413	0.441	0.496	...	
								3	81	89	98	106	114	123	131	148	...	
								4	...	...	...	...	...	...	...	179	...	

16x22	15½x21½	333.25	12837.07	1194.15	87 90	19	10.6	1	40220	44409	48598	52787	56976	61165	65354	73732	...	0.594
		1.056	1.106	1.081	1.056			2	0.307	0.337	0.368	0.399	0.429	0.460	0.491	0.552	......	
								3	72	80	87	95	102	110	117	132	......	
						20	11.2	1	38032	42011	45990	49969	53948	57927	61906	69864	77822	0.625
								2	0.340	0.374	0.408	0.442	0.476	0.510	0.544	0.612	0.680	
								3	65	72	78	85	92	99	105	119	133	
								4	.....	.....	.....	.....	.....	.....	.....	.....	179	
						21	11.7	1	36054	39844	43634	47424	51214	55004	58794	66374	73954	0.656
								2	0.375	0.412	0 449	0.487	0.525	0.562	0.599	0.674	0.749	
								3	59	65	71	77	83	89	95	108	120	
						22	12 3	1	34246	37864	41482	45100	48718	52336	55954	63190	70426	0.688
								2	0.411	0.453	0.493	0.535	0.576	0.617	0.658	0.740	0 823	
								3	53	59	64	70	76	81	87	98	109	
						23	12.8	1	32579	36039	39499	42959	46419	49879	53339	60259	67179	0.719
								2	0.450	0.495	0.539	0.584	0.630	0.674	0.720	0.809	0 900	
								3	48	53	59	64	69	74	79	89	100	
						24	13.4	1	31060	34377	37694	41011	44328	47645	50962	57596	64230	0.750
								2	0.489	0.538	0.587	0.636	0.685	0.734	0.783	0.880	0.978	
								3	44	49	54	58	63	68	72	82	91	
						25	14.0	1	29623	32805	35987	39169	42351	45533	48715	55079	....	0 781
								2	0.531	0.584	0.637	0 690	0.744	0.796	0.850	0.956	......	
								3	40	45	49	53	58	62	66	75	......	
						26	14.5	1	28325	31386	34447	37508	40569	43630	46691	......	......	0.813
								2	0.574	0.632	0.689	0.747	0.804	0.862	0.918	......	......	
								3	37	41	45	49	53	57	61	......	......	
						27	15.1	1	27108	30056	33004	35952	38900	41848	44796	......	......	0.844
								2	0.619	0.681	0.743	0.805	0.867	0.930	0.991	......	......	
								3	34	38	42	45	49	53	57	......	......	
						28	15.6	1	25949	28790	31631	34472	37313	40154	......	......	......	0.875
								2	0.666	0.733	0.800	0.866	0.933	1.000	......	......	......	
								3	32	35	39	42	45	49	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						29	16.2	1	24881	27624	30367	33110	35853	......	......	......	......	0.906
								2	0.714	0.786	0.857	0.928	1.000	......	......	......	......	
								3	29	32	36	39	42	......	......	......	......	
						30	16.7	1	23882	26534	29186	31838	......	......	......	......	......	0.938
								2	0.764	0.841	0.917	0.994	......	......	......	......	......	
								3	27	30	33	36	......	......	......	......	......	
16x22	15½x21½	333 25	12837.07	1194.15	87.90	31	17 3	1	22955	25523	28091	......	......	......	......	......	......	0.969
		1.056	1.106	1.081	1.056			2	0.817	0 898	0.981	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						32	17.9	1	22058	24545	......	......	......	......	......	......	......	1.000
								2	0.870	0.957	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						33	18.4	1	21209	......	......	......	......	......	......	......	......	1.031
								2	0.925	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	
								2	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
						16	8.2	1	57923	63869	69815	75761	81707	87653	......	......	......	0.500
								2	0.199	0.219	0.239	0.259	0.279	0.299	......	......	......	
								3	113	125	136	148	160	171	......	......	......	
								4	122	135	147	159	171	184	......	......	......	

16x24	15½x23½	364.25	16763.10	1426.65	96.10	17	8.7	1	54357	59956	65555	71154	76753	82352	87951	......	......	0.531
		1.054	1.100	1.076	1.054			2	0.225	0.247	0.270	0.292	0.316	0.337	0.359	......	......	
								3	100	110	121	131	141	151	162	......	......	
								4	......	......	......	......	......	......	185	......	......	
						18	9.2	1	51120	56405	61690	66975	72260	77545	82830	......	......	0.563
								2	0.252	0.277	0.302	0.327	0.353	0.378	0.403	......	......	
								3	89	98	107	116	125	135	144	......	......	
						19	9.7	1	48245	53252	58259	63266	68273	73280	78287	......	......	0.594
								2	0.281	0.309	0.337	0.365	0.393	0.421	0.449	......	......	
								3	79	88	96	104	112	121	129	......	......	
						20	10.2	1	45669	50428	55187	59946	64705	69464	74223	83741	......	0.625
								2	0.311	0.342	0.373	0.404	0.435	0.467	0.498	0.560	......	
								3	71	79	87	94	101	109	116	131	......	
								4	......	......	......	......	......	......	......	176	......	
						21	10.7	1	43291	47822	52353	56884	61415	65946	70477	79539	......	0.656
								2	0.343	0.377	0.411	0.446	0.480	0.514	0.549	0.617	......	
								3	64	71	78	85	91	98	105	118	......	
						22	11.2	1	41147	45473	49799	54125	58451	62777	67103	75755	84407	0.688
								2	0.376	0.414	0.452	0.489	0.527	0.564	0.602	0.677	0.753	
								3	58	65	71	77	83	89	95	108	120	
								4	......	......	......	......	......	......	......	......	178	
						23	11.7	1	39180	43319	47458	51597	55736	59875	64014	72292	80570	0.719
								2	0.411	0.453	0.494	0.535	0.576	0.617	0.658	0.740	0.823	
								3	53	59	64	70	76	81	87	98	109	
						24	12.3	1	37344	41309	45274	49239	53204	57169	61134	69064	76994	0.750
								2	0.448	0.493	0.537	0.582	0.627	0.672	0 716	0.806	0.895	
								3	49	54	59	64	69	74	80	90	100	
						25	12.8	1	35669	39476	43283	47090	50897	54704	58511	66125	73739	0.781
								2	0.486	0.534	0.583	0.632	0.680	0.729	0.777	0.874	0.971	
								3	45	49	54	59	64	68	73	83	92	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough In.	Size Surfaced S1S1E or S4S In.	Area Cross Section A=bh Sq. In.	Moment of Inertia $I=\frac{bh^3}{12}$ In.[4]	Section Modulus $S=\frac{bh^2}{6}$ In.[3]	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.) Lbs.	Span Ft.	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D In.
									Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									
						26	13.3	1	34102	37762	41422	45082	48742	52402	56062	63382	......	0.813
								2	0.525	0.578	0.630	0.683	0.735	0.788	0.840	0.946	......	
								3	41	45	50	54	59	63	67	76	......	
						27	13.8	1	32648	36172	39696	43220	46744	50268	53792	......	......	0.844
								2	0.567	0.623	0.680	0.737	0.793	0.850	0.907	......	......	
								3	38	42	46	50	54	58	62	......	......	
16x24	15½x23½	364.25	16763.10	1426.65	96.10	28	14.3	1	31300	34699	38098	41497	44896	48295	51694	......	......	0.875
		1.054	1.100	1.076	1.054			2	0.609	0.670	0.730	0.792	0.852	0.913	0.974	......	......	
								3	35	39	43	46	50	54	58	......	......	
						29	14.8	1	30024	33305	36586	39867	43148	46429	......	......	......	0.906
								2	0.653	0.719	0.784	0.850	0.915	0.980	......	......	......	
								3	32	36	39	43	47	50	......	......	......	
						30	15.3	1	28829	32000	35171	38342	41513	......	......	......	......	0.938
								2	0.700	0.770	0.840	0.910	0.980	......	......	......	......	
								3	30	33	37	40	43	......	......	......	......	
						31	15.8	1	27721	30791	33861	36931	......	......	......	......	......	0.969
								2	0.747	0.822	0.896	0.971	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						32	16.3	1	26657	29630	32603	......	......	......	......	......	......	1.000
								2	0.796	0.876	0.956	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	

						33	16.9	1	25660	28543	......	......	......	......	......	......	......	1.031
								2	0.846	0.931	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	
						34	17.4	1	24733	27533	......	......	......	......	......	......	......	1.063
								2	0.899	0.988	......	......	......	......	......	......	......	
16x24	15½x23½	364.25	16763.10	1426.65	96.10			3	23	25	......	......	......	......	......	......	......	
		1.054	1.100	1.076	1.054	35	17.9	1	23837	......	......	......	......	......	......	......	......	1 094
								2	0.952	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.08	1.08	1.08	1.08	1.08	1.08	1 08	1 08	1 08	
								2	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1 02	1.02	
						12	8.2	1	48640	53601	58562	63523	68484	73445	......	......	......	0.375
								2	0.150	0.165	0.180	0.195	0.210	0.225	......	......	......	
								3	150	165	181	196	211	227	......	......	......	
								4	122	134	146	158	170	182	......	......	......	
						13	8.9	1	44749	49329	53909	58489	63069	67649	72229	......	......	0.406
								2	0.176	0.194	0.212	0.229	0.247	0.265	0.282	......	......	
								3	128	141	154	167	180	193	206	......	......	
								4	......	......	......	......	......	......	180	......	......	
						14	9.6	1	41399	45652	49905	54158	58411	62664	66917	......	......	0.438
18x18	17½x17½	306.25	7815.76	893.23	80.80			2	0.205	0.225	0.246	0.266	0.287	0.307	0.327	......	......	
		1.058	1.120	1.088	1 058			3	110	121	132	143	155	166	177	......	......	
						15	10.3	1	38477	42446	46415	50384	54353	58322	62291	70229	......	0.469
								2	0.235	0.258	0.282	0.305	0.329	0.352	0.376	0.423	......	
								3	95	105	115	124	134	144	154	173	......	
								4	......	......	......	......	......	......	......	175	......	
						16	11.0	1	35917	39638	43359	47080	50801	54522	58243	65685	73127	0.500
								2	0.267	0.294	0.321	0.347	0.374	0.401	0.427	0.481	0.534	
								3	83	92	100	109	118	126	135	152	169	
								4	......	......	......	......	......	......	......	......	182	
						17	11 7	1	33646	37148	40650	44152	47654	51156	54658	61662	68666	0.531
								2	0.301	0.332	0.362	0.392	0.422	0.452	0.482	0.543	0.603	
								3	73	81	89	96	104	111	119	134	150	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						18	12.3	1	31625	34933	38241	41549	44857	48165	51473	58089	64705	0.563
								2	0.338	0.372	0.406	0.440	0.473	0.507	0.541	0.609	0.676	
								3	65	72	79	86	92	99	106	120	133	
						19	13.0	1	29795	32928	36061	39194	42327	45460	48593	54859	61125	0.594
								2	0.377	0.414	0.452	0.490	0.527	0.565	0.603	0.678	0.753	
								3	58	64	70	76	83	89	95	107	119	
						20	13.7	1	28154	31131	34108	37085	40062	43039	46016	51970	57924	0.625
								2	0.417	0.459	0.501	0.543	0.584	0.626	0.668	0.751	0.834	
								3	52	58	63	69	74	80	85	96	107	
18x18	17½x17½	306 25	7815.76	893.23	80.80	21	14.4	1	26663	29499	32335	35171	38007	40843	43679	49351	55023	0.656
		1.058	1 120	1.088	1.058			2	0.460	0.506	0.552	0.598	0.644	0.690	0.736	0.828	0.920	
								3	47	52	57	62	67	72	77	87	97	
						22	15.1	1	25292	27999	30706	33413	36120	38827	41534	46948	......	0.688
								2	0.505	0.556	0.606	0.657	0.708	0.758	0.808	0 909		
								3	43	47	52	56	61	65	70	79	......	
						23	15.8	1	24031	26620	29209	31798	34387	36976	39565	44743	......	0.719
								2	0.552	0.608	0.663	0.718	0.773	0.829	0.884	0.994	......	
								3	39	43	47	51	55	60	64	72	......	
						24	16.5	1	22870	25351	27832	30313	32794	35275	37756	......	......	0.750
								2	0.601	0.661	0.721	0.781	0.841	0.901	0.961	......	......	
								3	35	39	43	47	51	54	58	......	......	

						25	17.1	1	21790	24171	26552	28933	31314	33695	......	......	......	0.781
								2	0.652	0.718	0.783	0.848	0.914	0.979	......	......	......	
								3	32	36	39	43	46	50	......	......	......	
						26	17.8	1	20799	23089	25379	27669	29959	......	......	......	......	0.813
								2	0.705	0.775	0.846	0.917	0.987	......	......	......	......	
								3	30	33	36	39	43	......	......	......	......	
						27	18.5	1	19859	22063	24267	26471	......	......	......	......	......	0.844
								2	0.761	0.837	0.913	0.989	......	......	......	......	......	
								3	27	30	33	36	......	......	......	......	......	
18x18	17½x17½	306.25	7815.76	893.23	80.80	28	19.2	1	19008	21135	23262	......	......	......	......	......	......	0.875
		1.058	**1.120**	**1.088**	**1.058**			2	0.818	0.900	0.982	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						29	19.9	1	18177	20229	......	......	......	......	......	......	......	0.906
								2	0.877	0.965	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						30	20.6	1	17426	......	......	......	......	......	......	......	......	0.938
								2	0.939	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	
						14	8.6	1	51539	56819	62099	67379	72659	77939	......	......	......	0.438
								2	0.184	0.202	0.221	0.239	0.257	0.276	......	......	......	
								3	123	135	148	160	173	186	......	......	......	
								4	116	128	139	151	163	174	......	......	......	
18x20	17½x19½	341.25	10813.37	1109.06	90.05	15	9.2	1	47929	52857	57785	62713	67641	72569	77497	......	......	0.469
		1.055	**1.110**	**1.082**	**1.055**			2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	......	......	
								3	107	118	128	139	150	161	172	......	......	
								4	......	......	......	......	......	......	173	......	......	
						16	9.8	1	44759	49379	53999	58619	63239	67859	72479	81719	......	0.500
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	......	
								3	93	103	113	122	132	141	151	170	......	
								4	......	......	......	......	......	......	......	183	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
18x20	$17\frac{1}{2}$x$19\frac{1}{2}$	341.25	10813.37	1109.06	90.95	17	10.5	1	41939	46286	50633	54980	59327	63674	68021	76715	......	0.531
		1.055	1.110	1.082	1.055			2	0.271	0.298	0.324	0.352	0.379	0.406	0.433	0.487	......	
								3	82	91	99	108	116	125	133	150	......	
						18	11.1	1	39439	43545	47651	51757	55863	59969	64075	72287	80499	0.563
								2	0.304	0.334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	73	81	88	96	104	111	119	134	149	
								4	....	....	....	....	....	....	....	....	181	
						19	11.7	1	37199	41090	44981	48872	52763	56654	60545	68327	76109	0.594
								2	0.338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	65	72	79	86	93	99	106	120	134	
						20	12.3	1	35159	38855	42551	46247	49943	53639	57335	64727	72119	0.625
								2	0.375	0.412	0.449	0.487	0.524	0.562	0.599	0.674	0.749	
								3	59	65	71	77	83	89	96	108	120	
						21	12.9	1	33309	36829	40349	43869	47389	50909	54429	61469	68509	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	
								3	53	59	64	70	75	81	86	98	109	
						22	13.5	1	31619	34979	38339	41699	45059	48419	51779	58499	65219	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	48	53	58	63	68	73	78	89	99	

Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated (columns 1000–2000).

						23	14.2	1	30059	33272	36485	39698	42911	46124	49337	55763	62189	0.719
								2	0.496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	
								3	44	48	53	58	62	67	72	81	90	
						24	14.8	1	28639	31719	34799	37879	40959	44039	47119	53279	.	0.750
								2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	.	
								3	40	44	48	53	57	61	65	74	.	
						25	15.4	1	27319	30276	33233	36190	39147	42104	45061	....	..	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	..	.	
								3	36	40	44	48	52	56	60	..	...	
						26	16.0	1	26079	28921	31763	34605	37447	40289	..	...	.	0.813
								2	0.633	0.696	0.760	0.824	0.887	0.950		.		
								3	33	37	41	44	48	52				
						27	16.6	1	24959	27698	30437	33176	35915	.				0.844
								2	0.683	0.752	0.820	0.888	0.956				.	
								3	31	34	38	41	44					
18x20	17½x19½	341.25	10813.37	1109.06	90.05	28	17.2	1	23879	26519	29159	31799	.		.			0.875
		1.055	**1.110**	**1.082**	**1.055**			2	0.735	0.808	0.882	0.955				..	.	
								3	28	32	35	38				..	.	
						29	17.8	1	22879	25428	27977	..	..	.	...	....	..	0.906
								2	0.788	0.867	0.946	...				...	....	
								3	26	29	32	...		.	...	.....	.....	
						30	18.5	1	21929	24392	.....	....	.....	....	....	.....	..	0.938
								2	0.843	0.928	......	....	......	.....	..	......	...	
								3	24	27	......	.....	......	..	..	......	.....	
						31	19.1	1	21039	23422	.....	.....	.....	....	...	.	...	0.969
								2	0.901	0.991	.....	.....	....	.....	....	....	...	
								3	23	25	.....	......	......	.....	....	.....	...	
						32	19.7	1	20219	.....	......	.....	.. .	.....	.....	......	.....	1.000
								2	0.959	......	......	.....	......	.....	.....	.....	..	
								3	21	......	......	......	......	.....	......	......	....	
						Multiplying Factor		1	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	
								2	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	
								4	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	**1.03**	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
						15	8.4	1	58421	64412	70403	76394	82385	88376	......	......	......	0.469
								2	0.191	0.210	0.229	0.248	0.268	0.287	......	......	......	
								3	118	130	142	154	166	179	......	......	......	
								4	120	132	143	155	167	179	......	......	......	
						16	8.9	1	54602	60221	65840	71459	77078	82697	88316	......	......	0.500
								2	0.217	0.239	0.261	0.283	0.304	0.326	0.348	......	......	
								3	103	114	125	135	146	157	167	......	......	
								4	......	......	......	......	......	......	179	......	......	
						17	9.5	1	51183	56470	61757	67044	72331	77618	82905	......	......	0.531
18x22	17½x21½	376.25	14493.47	1348.23	99.26			2	0.245	0.270	0.295	0.319	0.344	0.368	0.393	......	......	
		1 052	1.102	1.077	1 052			3	91	101	110	120	129	138	148	......	......	
						18	10.0	1	48123	53114	58105	63096	68087	73078	78069	88051	......	0.563
								2	0.275	0.303	0.330	0.358	0.386	0.413	0.441	0.496	......	
								3	81	89	98	106	115	123	132	148	......	
								4	......	......	......	......	......	......	......	179	......	
						19	10.6	1	45414	50144	54874	59604	64334	69064	73794	83254	......	0.594
								2	0.307	0.337	0.368	0.399	0.429	0.460	0.491	0.552	......	
								3	72	80	88	95	103	110	118	133	......	
						20	11.2	1	42945	47438	51931	56424	60917	65410	69903	78889	87875	0.625
								2	0.340	0.374	0.408	0.442	0.476	0.510	0.544	0.612	0.680	
								3	65	72	79	86	92	99	106	120	133	
								4	......	......	......	......	......	......	......	......	179	

						21	11.7	1	40715	44995	49275	53555	57835	62115	66395	74955	83515	0.656
								2	0.375	0.412	0.449	0.487	0.525	0 562	0.599	0.674	0.749	
								3	59	65	71	77	84	90	96	108	121	
						22	12.3	1	38676	42762	46848	50934	55020	59106	63192	71364	79536	0 688
								2	0.411	0.453	0.493	0.535	0.576	0.617	0.658	0.740	0.823	
								3	53	59	65	70	76	81	87	98	110	
						23	12 8	1	36807	40716	44625	48534	52443	56352	60261	68079	75897	0.719
								2	0.450	0.495	0.539	0.584	0.630	0.674	0.720	0 809	0.900	
								3	49	54	59	64	69	74	79	90	100	
						24	13.4	1	35068	38813	42558	46303	50048	53793	57538	65028	72518	0.750
								2	0.489	0.538	0.587	0.636	0.685	0.734	0.783	0.880	0.978	
								3	44	49	54	58	63	68	73	82	92	
						25	14.0	1	33469	37064	40659	44254	47849	51444	55039	62229	......	0.781
								2	0.531	0.584	0.637	0.690	0.744	0.796	0.850	0 956	......	
								3	41	45	49	54	58	62	67	75	......	
18x22	17½x21½	376.25	14493.47	1348 23	99.26	26	14.5	1	31999	35457	38915	42373	45831	49289	52747	......	......	0.813
		1.052	1 102	1.077	1.052			2	0.574	0 632	0.689	0.747	0.804	0.862	0.918	......	......	
								3	37	41	45	49	53	57	61	......	......	
						27	15.1	1	30610	33939	37268	40597	43926	47255	50584	......	......	0.844
								2	0.619	0.681	0.743	0.805	0.867	0.930	0.991	......	......	
								3	34	38	42	46	49	53	57	......	......	
						28	15.6	1	29320	32530	35740	38950	42160	45370	......	......	......	0.875
								2	0.666	0.733	0.800	0.866	0.933	1.000	......	......	......	
								3	32	35	39	42	46	49	......	......	......	
						29	16.2	1	28121	31221	34321	37421	40521	......	......	......	......	0.906
								2	0.714	0.786	0.857	0.928	1.000	......	......	......	......	
								3	29	32	36	39	42	......	......	......	......	
						30	16.7	1	26981	29977	32973	35969	......	......	......	......	......	0.938
								2	0.764	0.841	0.917	0.994	......	......	......	......	......	
								3	27	30	33	36	......	......	......	......	......	
						31	17.3	1	25922	28822	31722	......	......	......	......	......	......	0.969
								2	0.817	0.898	0.981	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot Based on Green Timber at 38 lbs. per cu. ft.	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Ft.												In.
						32	17.9	1	24913	27722	......	......	......	......	......	......	......	1.000
								2	0.870	0.957	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	
18x22	17½x21½	376 25	14493.47	1348 23	99 26	33	18.4	1	23953	......	......	......	......	......	......	......	......	1.031
								2	0.925	......	......	......	......	......	......	......	......	
		1 052	1.102	1 077	1 052			3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	
								2	0.98	0.98	0.98	0.98	0 98	0 98	0 98	0 98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
						16	8.2	1	65403	72117	78831	85545	92259	98973	......	......	......	0.500
								2	0.199	0.219	0.239	0.259	0.279	0.299	......	......	......	
								3	114	125	137	149	160	172	......		......	
								4	122	135	147	159	171	184	......	......	......	
18x24	17½x23½	411.25	18926.08	1610.73	108.55	17	8 7	1	61355	67675	73995	80315	86635	92955	99275	......	......	0.531
		1 050	1 095	1 072	1 050			2	0.225	0 247	0 270	0 292	0 315	0 337	0.359	......	......	
								3	100	111	121	131	142	152	162	......	......	
								4	......	......	......	......	......	......	185	......		
						18	9 2	1	57716	63683	69650	75617	81584	87551	93518	......	......	0.563
								2	0.252	0.277	0.302	0 327	0 353	0.378	0.403	......	......	
								3	89	99	108	117	126	135	144	......	......	

						19	9.7	1	54478	60132	65786	71440	77094	82748	88402	......	......	0.594
								2	0.281	0.309	0.337	0.365	0.393	0.421	0.449	......	......	
								3	80	88	96	105	113	121	129	......	......	
						20	10.2	1	51539	56910	62281	67652	73023	78394	83765	94507	......	0.625
								2	0.311	0.342	0.373	0.404	0.435	0.467	0.498	0.560	......	
								3	72	79	87	94	101	109	116	131	......	
								4	...	...	....	......	......	......	......	176	......	
						21	10.7	1	48900	54018	59136	64254	69372	74490	79608	89844	......	0.656
								2	0.343	0.377	0.411	0.446	0.480	0.514	0.549	0.617	......	
								3	65	72	78	85	92	99	105	119	.....	
						22	11.2	1	46441	51324	56207	61090	65973	70856	75739	85505	95271	0.688
								2	0.376	0.414	0.452	0.489	0.527	0.564	0.602	0.677	0.753	
								3	59	65	71	77	83	90	96	108	120	
								4	......	.....	......	......	......	......	......	......	178	
18x24	17½x23½	411.25 1.050	18926.08 1.095	1610.73 1.072	108.55 1.050	23	11.7	1	44212	48883	53554	58225	62896	67567	72238	81580	90922	0.719
								2	0.411	0.453	0.494	0.535	0.576	0.617	0.658	0.740	0.823	
								3	53	59	65	70	76	82	87	99	110	
						24	12.3	1	42174	46652	51130	55608	60086	64564	69042	77998	86954	0.750
								2	0.448	0.493	0.537	0.582	0.627	0.672	0.716	0.806	0.895	
								3	49	54	59	64	70	75	80	90	101	
						25	12.8	1	40276	44575	48874	53173	57472	61771	66070	74668	83266	0.781
								2	0.485	0.534	0.583	0.632	0.680	0.729	0.777	0.874	0.971	
								3	45	50	54	59	64	69	73	83	93	
						26	13.3	1	38498	42630	46762	50894	55026	59158	63290	71554	.....	0.813
								2	0.525	0.578	0.630	0.683	0.735	0.788	0.840	0.946	......	
								3	41	46	50	54	59	63	68	76	......	
						27	13.8	1	36869	40849	44829	48809	52789	56769	60749	......	.....	0.844
								2	0.567	0.623	0.680	0.737	0.793	0.850	0.907	......	......	
								3	38	42	46	50	54	58	63	....	.	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
						28	14.3	1	35330	39167	43004	46841	50678	54515	58352			0.875
								2	0.609	0.670	0.730	0.792	0.852	0.913	0.974			
								3	35	39	43	46	50	54	58			
						29	14.8	1	33921	37628	41335	45042	48749	52456				0.906
								2	0.653	0.719	0.784	0.850	0.915	0.980				
								3	33	36	40	43	47	50				
						30	15.3	1	32552	36133	39714	43295	46876					0.938
								2	0.700	0.770	0.840	0.910	0.980					
								3	30	33	37	40	43					
18x24	17½x23½	411.25	18926.08	1610.73	108.55	31	15.8	1	31304	34771	38238	41705						0.969
		1 050	1 095	1 072	1 050			2	0.747	0.822	0.896	0.971						
								3	28	31	34	37						
						32	16.3	1	30117	33476	36835							1.000
								2	0.796	0.876	0.956							
								3	26	29	32							
						33	16.9	1	28987	32244								1.031
								2	0.846	0.931								
								3	24	27								
						34	17.4	1	27919	31080								1.063
								2	0.899	0.988								
								3	23	25								

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

18x26	$17\frac{1}{2}$x$25\frac{1}{2}$	446.25 1.048	24181.18 1.090	1896.56 1.068	117.70 1.048	35	17.9	1 2 3	26900 0.952 21	....	....	....	....	....	....	....	....	1.094
						Multiplying Factor		1 2 4	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	1.07 0.98 1.02	
						18	8.5	1 2 3 4	68130 0.232 97 118	75155 0.255 107 130	82180 0.278 117 142	89205 0.302 127 154	96230 0.325 137 165	103255 0.348 147 177	....	....	....	0.563
						19	8.9	1 2 3 4	64342 0.258 87	71000 0.284 96	77658 0.310 105	84316 0.336 114	90974 0.362 123	97632 0.388 132	104290 0.414 141 179	....	....	0.594
						20	9.4	1 2 3	60865 0.286 78	67187 0.315 86	73509 0.344 94	79831 0.374 102	86153 0.401 110	92475 0.430 119	98797 0.458 127	....	....	0.625
						21	9.9	1 2 3 4	57738 0.316 71	63759 0.348 78	69780 0.379 85	75801 0.411 93	81822 0.442 100	87843 0.474 107	93864 0.505 115	105906 0.568 129 182	....	0.656
						22	10.4	1 2 3	54889 0.347 64	60637 0.381 71	66385 0.415 77	72133 0.451 84	77881 0.485 91	83629 0.520 98	89377 0.554 104	100873 0.624 118	....	0.688
						23	10.8	1 2 3 4	52291 0.379 58	57791 0.417 64	63291 0.455 71	68791 0.493 77	74291 0.531 83	79791 0.569 89	85291 0.607 95	96291 0.682 107	107291 0.758 120 185	0.719
						24	11.3	1 2 3	49873 0.412 53	55143 0.454 59	60413 0.495 65	65683 0.536 70	70953 0.577 76	76223 0.618 81	81493 0.660 87	92033 0.742 98	102573 0.824 110	0.750

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									Deflection equivalent to 1/32 Inch per Foot of Span
Rough	Surfaced S1S1E or S4S	A=bh	$I=\frac{bh^3}{12}$	$S=\frac{bh^2}{6}$			l/h		1000	1100	1200	1300	1400	1500	1600	1800	2000	D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
								1	47647	52706	57765	62824	67883	72942	78001	88119	98237	
						25	11.8	2	0.448	0.493	0.537	0.582	0.627	0.672	0.716	0.806	0.896	0.781
								3	49	54	59	64	70	75	80	90	101	
								1	45589	50454	55319	60184	65049	69914	74779	84509	94239	
						26	12.2	2	0.484	0.532	0.581	0.629	0.678	0.726	0.774	0.871	0.968	0.813
								3	45	50	55	59	64	69	74	83	93	
								1	43651	48334	53017	57700	62383	67066	71749	81115	......	
						27	12.7	2	0.522	0.574	0.626	0.679	0.731	0.783	0.835	0.940	......	0.844
								3	41	46	50	55	59	64	68	77	......	
								1	41883	46401	50919	55437	59955	64473	68991	......	......	
18x26	17½x25½	446.25	24181.18	1896.56	117.70	28	13.2	2	0.561	0.618	0.674	0.730	0.786	0.842	0.898	......	......	0.875
		1.048	1.090	1.068	1.048			3	38	42	47	51	55	59	63	......	......	
								1	40195	44556	48917	53278	57639	62000	66361	......	......	
						29	13.6	2	0.602	0.662	0.722	0.783	0.843	0.903	0.963	......	......	0.906
								3	36	39	43	47	51	55	59	......	......	
								1	38648	42866	47084	51302	55520	59738	......	......	......	
						30	14.1	2	0.644	0.709	0.773	0.838	0.902	0.967	......	......	......	0.938
								3	33	37	40	44	47	51	......	......	......	
								1	37150	41230	45310	49390	53470	......	......	......	......	
						31	14.6	2	0.688	0.757	0.826	0.895	0.964	......	......	......	......	0.969
								3	31	34	37	41	44	......	......	......	......	

						32	15.1	1	35751	39703	43655	47607	......	......	......	......	......	
								2	0.733	0.806	0.882	0.954	......	......	......	......	......	1.000
								3	29	32	35	38	......	......	......	......	......	
						33	15.5	1	34425	38256	42087	......	......	......	......	......	......	
								2	0.780	0.858	0.935	......	......	......	......	......	......	1.031
								3	27	30	33	......	......	......	......	......		
						34	16.0	1	33196	36916	40636	......	......	......	......	......	......	
								2	0.828	0.911	0.993	......	......	......	......	......	......	1.063
18x26	17½x25½	446 25	24181.18	1896.56	117.70			3	25	28	31	......	......					
						35	16.5	1	32009	35622	......	......	......	......	......	......	......	
		1.048	1.090	1.068	1.048			2	0.877	0.966	......	......	......	......	......	......	......	1.094
								3	23	26	......							
						36	16.9	1	30881	......	......	......	......	......	......	......	......	
								2	0.928	......	......	......	......	......	......	......	......	1.125
								3	22	......								
						Multiplying Factor		1	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
								2	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
						14	8 6	1	57435	63319	69203	75087	80971	86855	......	......	......	
								2	0.184	0.202	0.221	0.239	0.257	0.276	......	......	......	0.438
								3	123	136	148	161	174	186	......	......	......	
								4	116	128	139	151	163	174	......	......	......	
						15	9.2	1	53435	58929	64423	69917	75411	80905	86399	......	......	
								2	0.211	0.232	0.253	0.274	0.295	0.316	0.337	......	......	0.469
20x20	19½x19½	380.25	12049.18	1235 81	100 37			3	107	118	129	140	151	162	173	......	......	
								4	......	......	......	......	......	......	173	......	......	
		1.051	1 106	1 078	1.051	16	9.8	1	49904	55055	60206	65357	70508	75659	80810	91112	......	
								2	0.240	0.264	0.288	0.312	0.336	0.360	0.384	0.432	......	0.500
								3	94	103	113	123	132	142	152	171	......	
								4	......	......	......	......	......	......	......	183	......	
						17	10.5	1	46774	51622	56470	61318	66166	71014	75862	85558	......	
								2	0.271	0.298	0.324	0 352	0.379	0.406	0.433	0.487	......	0.531
								3	82	91	100	108	117	125	134	151	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						18	11.1	1	43984	48563	53142	57721	62300	66879	71458	80616	89774	0 563
								2	0.304	0 334	0.364	0.395	0.425	0.455	0.486	0.547	0.607	
								3	73	81	89	96	104	112	119	134	150	
								4	......	......	......	......	......	......	......	......	181	
						19	11.7	1	41483	45822	50161	54500	58839	63178	67517	76195	84873	0.594
								2	0 338	0.372	0.406	0.440	0.474	0.507	0.541	0.609	0.676	
								3	66	72	79	86	93	100	107	120	134	
						20	12 3	1	39202	43323	47444	51565	55686	59807	63928	72170	80412	0.625
								2	0.375	0 412	0.449	0.487	0.524	0.562	0.599	0 674	0 749	
20x20	19½x19½	380.25	12049.18	1235.81	100 37			3	59	65	71	77	84	90	96	108	121	
		1 051	1 106	1 078	1 051	21	12.9	1	37142	41067	44992	48917	52842	56767	60692	68542	76392	0.656
								2	0.413	0.454	0.496	0.537	0.578	0.619	0.661	0.743	0.826	
								3	53	59	64	70	76	81	87	98	109	
						22	13 5	1	35261	39008	42755	46502	50249	53996	57743	65237	72731	0.688
								2	0.454	0.499	0.544	0.589	0.635	0.680	0.725	0.816	0.907	
								3	48	53	58	63	69	74	79	89	99	
						23	14.2	1	33521	37104	40687	44270	47853	51436	55019	62185	69351	0.719
								2	0 496	0.545	0.595	0.644	0.694	0.743	0.793	0.892	0.991	
								3	44	48	53	58	62	67	72	81	90	
						24	14.8	1	31921	35354	38787	42220	45653	49086	52519	59385	.....	0.750
								2	0.539	0.593	0.647	0.701	0.755	0.809	0.863	0.971	......	
								3	40	44	48	53	57	61	66	74	......	

						25	15 4	1	30461	33758	37055	40352	43649	46946	50243	......	......	0.781
								2	0.586	0.644	0.703	0.761	0.820	0.878	0.937	......	......	
								3	37	41	44	48	52	56	60	......	......	
						26	16 0	1	29081	32250	35419	38588	41757	44926	......	......	......	0 813
								2	0.633	0.696	0.760	0.824	0.887	0.950	......	......	......	
								3	34	37	41	45	48	52	......	......	......	
						27	16 6	1	27800	30851	33902	36953	40004	......	......	......	......	0.844
								2	0.683	0.752	0.820	0.888	0.956	......	......	......	......	
								3	31	34	38	41	44	......	......	......	......	
						28	17 2	1	26620	29563	32506	35449	......	......	......	......	......	0.875
								2	0.735	0.808	0.882	0.955	......	......	......	......	......	
								3	29	32	35	38	......	......	......	......	......	
20x20	19½x19½	380.25	12049.18	1235.81	100.37	29	17.8	1	25510	28352	31194	......	......	......	......	......	......	0.906
		1.051	1.106	1.078	1.051			2	0.788	0.867	0.946	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						30	18.5	1	24480	27229	......	......	......	......	......	......	......	0 938
								2	0.843	0.928	......	......	......	......	......	......	......	
								3	24	27	......	......	......	......	......	......	......	
						31	19.1	1	23480	26139	......	......	......	......	......	......	......	0.969
								2	0.901	0.991	......	......	......	......	......	......	......	
								3	23	25	......	......	......	......	......	......	......	
						32	19.7	1	22549	......	......	......	......	......	......	......	......	1.000
								2	0.959	......	......	......	......	......	......	......	......	
								3	21	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	
								2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	
								4	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1 03	1.03	
20x22	19½x21½	419.25	16149.87	1502.31	110.60	15	8.4	1	65130	71809	78488	85167	91846	98525	......	......	......	0.469
								2	0.191	0.210	0.229	0.248	0.268	0.287	......	......	......	
								3	118	131	143	155	167	179	......	......	......	
		1.049	1.099	1.074	1.049			4	120	132	143	155	167	179	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.			Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									In.
								1	60830	67090	73350	79610	85870	92130	98390	......	......	
						16	8.9	2	0.217	0.239	0.261	0.283	0.304	0.326	0.348	......	......	0.500
								3	.104	114	125	136	146	157	168	......	......	
								4	...	....	...	...	..	......	179		....	
								1	57029	62920	68811	74702	80593	86484	92375	....	....	
						17	9.5	2	0.245	0.270	0.295	0.319	0.344	0.368	0.393	...	......	0.531
								3	92	101	110	120	129	139	148	...	....	
								1	53639	59202	64765	70328	75891	81454	87017	98143	....	
						18	10.0	2	0.275	0.303	0.330	0.358	0.386	0.413	0.441	0.496	....	0.563
								3	81	90	98	107	115	123	132	149	.	
20x22	19½x21½	419.25	16149.87	1502.31	110.60			4		.	...	...	....	....	.....	179	...	
		1.049	1.099	1.074	1.049			1	50608	55879	61150	66421	71692	76963	82234	92776	....	
						19	10.6	2	0.307	0.337	0.368	0.399	0.429	0.460	0.491	0.552	....	0.594
								3	73	80	88	95	103	110	118	133	.....	
								1	47878	52887	57896	62905	67914	72923	77932	87950	97968	
						20	11.2	2	0.340	0.374	0.408	0.442	0.476	0.510	0.544	0.612	0.680	0.625
								3	65	72	79	86	93	99	106	120	134	
								4	....	....	.....	...	...	...	..	....	179	
								1	45367	50136	54905	59674	64443	69212	73981	83519	93057	
						21	11.7	2	0.375	0.412	0.449	0.487	0.525	0.562	0.599	0.674	0.749	0.656
								3	59	65	71	78	84	90	96	108	121	

20x22	19½x21½	419.25 1.049	16149.87 1.099	1502.31 1.074	110.60 1.049	22	12.3	1	43096	47649	52202	56755	61308	65861	70414	79520	88626	0.688
								2	0.411	0.453	0.493	0.535	0.576	0.617	0.658	0.740	0.823	
								3	53	59	65	70	76	82	87	99	110	
						23	12.8	1	40995	45349	49703	54057	58411	62765	67119	75827	84535	0.719
								2	0.450	0.495	0.539	0.584	0.630	0.674	0.720	0.809	0.900	
								3	49	54	59	64	69	74	80	90	100	
						24	13.4	1	39065	43237	47409	51581	55753	59925	64097	72441	80785	0.750
								2	0.489	0.538	0.587	0.636	0.685	0.734	0.783	0.880	0.978	
								3	44	49	54	59	63	68	73	82	92	
						25	14.0	1	37314	41322	45330	49338	53346	57354	61362	69378	......	0.781
								2	0.531	0.584	0.637	0.690	0.744	0.796	0.850	0.956	......	
								3	41	45	49	54	58	63	67	76	......	
						26	14.5	1	35643	39495	43347	47199	51051	54903	58755	......	......	0.813
								2	0.574	0.632	0.689	0.747	0.804	0.862	0.918	......	......	
								3	37	41	45	50	54	58	62	......	......	
						27	15.1	1	34112	37822	41532	45242	48952	52662	56372	......	......	0.844
								2	0.619	0.681	0.743	0.805	0.867	0.930	0.991	......	......	
								3	34	38	42	46	49	53	57	......	......	
						28	15.6	1	32681	36259	39837	43415	46993	50571	......	......	......	0.875
								2	0.666	0.733	0.800	0.866	0.933	1.000	......	......	......	
								3	32	35	39	42	46	49	......	......	......	
						29	16.2	1	31321	34774	38227	41680	45133	......	......	......	......	0.906
								2	0.714	0.786	0.857	0.928	1.000	......	......	......	......	
								3	29	33	36	39	42	......	......	......	......	
						30	16.7	1	30071	33410	36749	40088	......	......	......	......	......	0.938
								2	0.764	0.841	0.917	0.994	......	......	......	......	......	
								3	27	30	33	36	......	......	......	......	......	
						31	17.3	1	28880	32111	35342	......	......	......	......	......	......	0.969
								2	0.817	0.898	0.981	......	......	......	......	......	......	
								3	25	28	31	......	......	......	......	......	......	
						32	17.9	1	27760	30890	......	......	......	......	......	......	......	1.000
								2	0.870	0.957	......	......	......	......	......	......	......	
								3	24	26	......	......	......	......	......	......	......	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
20x22	19½x21½	419.25	16149.87	1502.31	110.60	33	18.4	1	26710	...	...	...	...	...	...	...	...	1.031
								2	0.925	...	...	...	...	...	...	...	...	
								3	22	...	...	...	...	...	...	...	...	
		1.049	1.099	1.074	1.049	Multiplying Factor		1	1.07	1 07	1 07	1 07	1 07	1.07	1.07	1 07	1 07	
								2	0 98	0.98	0.98	0 98	0 98	0 98	0 98	0 98	0 98	
								4	1.02	1.02	1.02	1.02	1 02	1.02	1.02	1 02	1.02	
20x24	19½x23½	458 25	21089 06	1794 81	120 92	16	8 2	1	72836	80313	87790	95267	102744	110221	...			0.500
								2	0.199	0.219	0.239	0.259	0.279	0.299	...			
								3	114	125	137	149	161	172	...			
								4	122	135	147	159	171	184	...			
						17	8 7	1	68335	75374	82413	89452	96491	103530	110569			0.531
								2	0.225	0.247	0 270	0 292	0 315	0 337	0.359			
								3	101	111	121	132	142	152	163			
								4	...	...	...	...	...	...	185			
		1 047	1 093	1 070	1 047													
						18	9 2	1	64275	70920	77565	84210	90855	97500	104145			0.563
								2	0.252	0.277	0 302	0.327	0.353	0.378	0.403			
								3	89	98	108	117	126	135	145			
						19	9 7	1	60694	66933	73292	79591	85890	92189	98488	...	...	0.594
								2	0.281	0.309	0.337	0.365	0.393	0.421	0.449	...	...	
								3	80	88	96	105	113	121	130	...	...	

Columns 1000–2000: Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated

20x24	19½x23½	458.25 1.047	21089.06 1.093	1794.81 1.070	120.92 1.047	20	10.2	1	57382	63362	69342	75322	81302	87282	93262	105222	...	0.625
								2	0.311	0.342	0.373	0.404	0.435	0.467	0.498	0 560	...	
								3	72	79	87	94	102	109	117	132	...	
								4	...	...	...	...	...	...	...	176	...	
						21	10.7	1	54451	60150	65849	71548	77247	82946	88645	100043	...	0.656
								2	0.343	0.377	0.411	0.446	0.480	0.514	0.549	0.617	...	
								3	65	72	78	85	92	99	106	119	...	
						22	11.2	1	51730	57169	62608	68047	73486	78925	84364	95242	106120	0.688
								2	0.376	0.414	0.452	0.489	0.527	0.564	0.602	0.677	0.753	
								3	59	65	71	77	84	90	96	108	121	
								4	...	...	...	...	...	...	...	...	178	
						23	11.7	1	49230	54431	59632	64833	70034	75235	80436	90838	101240	0.719
								2	0.411	0.453	0.494	0.535	0.576	0.617	0.658	0.740	0.823	
								3	54	59	65	71	76	82	87	99	110	
						24	12.3	1	46950	51935	56920	61905	66890	71875	76860	86830	96800	0.750
								2	0.448	0.493	0.537	0.582	0.627	0.672	0.716	0.806	0.895	
								3	49	54	59	64	70	75	80	90	101	
						25	12.8	1	44839	49625	54411	59197	63983	68769	73555	83127	92699	0.781
								2	0.486	0.534	0.583	0.632	0.680	0.729	0.777	0.874	0.971	
								3	45	50	54	59	64	69	74	83	93	
						26	13.3	1	42868	47469	52070	56671	61272	65873	70474	79676	...	0.813
								2	0.525	0.578	0.630	0.683	0.735	0.788	0.840	0.946	...	
								3	41	46	50	55	59	63	68	77	...	
						27	13.8	1	41048	45479	49910	54341	58772	63203	67634	...	...	0.844
								2	0.567	0.623	0.680	0.737	0.793	0.850	0.907	...	...	
								3	38	42	46	50	54	59	63	...	...	
						28	14.3	1	39337	43609	47881	52153	56425	60697	64969	...	...	0.875
								2	0.609	0.670	0.730	0.792	0.852	0.913	0.974	...	...	
								3	35	39	43	46	50	54	58	...	...	
						29	14.8	1	37745	41870	45995	50120	54245	58370	...	...	...	0.906
								2	0.653	0.719	0.784	0.850	0.915	0.980	...	...	...	
								3	33	36	40	43	47	50	...	...	...	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
									Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated									
						30	15.3	1	36254	40242	44230	48218	52206	....				0.938
								2	0.700	0.770	0.840	0.910	0.980	...				
								3	30	34	37	40	44					
						31	15.8	1	34843	38702	42561	46420	..					0.969
								2	0.747	0.822	0.896	0.971						
								3	28	31	34	37						
						32	16.3	1	33522	37261	41000	.						1.000
								2	0.796	0.876	0.956	.						
20x24	19½x23½	458.25	21089.06	1794.81	120.92			3	26	29	32	....						
						33	16.9	1	32271	35897	..							1.031
		1.047	1.093	1.070	1.047			2	0.846	0.931	.							
								3	24	27								
						34	17.4	1	31080	34590								1.063
								2	0.899	0.988								
								3	23	25								
						35	17.9	1	29960	...								1.094
								2	0.952	..								
								3	21	....								
						Multiplying Factor		1	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
								2	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

						18	8.5	1	75919	83747	91575	99403	107231	115059				0.563
								2	0.232	0.255	0.278	0.302	0.325	0.348				
								3	97	107	117	127	138	148				
								4	118	130	142	154	165	177				
						19	8.9	1	71688	79108	86524	93942	101360	108778	116196			0.594
								2	0.258	0.284	0.310	0.336	0.362	0.388	0.414			
								3	87	96	105	114	123	132	141			
								4	...	....	.	....	...	.	179			
						20	9.4	1	67836	74882	81928	88974	96020	103066	110112	..		0.625
								2	0.286	0.315	0.344	0.374	0.401	0.430	0.458	......	..	
								3	78	86	94	103	111	119	127	..		
						21	9.9	1	64393	71108	77823	84538	91253	97968	104683	118113		0.656
								2	0.316	0.348	0.379	0.411	0.442	0.474	0.505	0.568		
								3	71	78	86	93	100	108	115	130		
								4	.....	......	....	....	...		......	182		
20x26	19½x25½	497.25	26944.74	2113.31	131.20	22	10.4	1	61163	67568	73973	80378	86783	93188	99593	112403		0.688
		1.046	1.086	1.065	1.046			2	0.347	0.381	0.415	0.451	0.485	0.520	0.554	0.624	......	
								3	64	71	78	84	91	98	104	118	......	
						23	10.8	1	58281	64411	70541	76671	82801	88931	95061	107321	119581	0.719
								2	0.379	0.417	0.455	0.493	0.531	0.569	0.607	0.682	0.758	
								3	59	65	71	77	83	89	95	108	120	
								4	......	....	.....	.....	.....	.....		..	185	
						24	11.3	1	55570	61442	67314	73186	79058	84930	90802	102546	114290	0.750
								2	0.412	0.454	0.495	0.536	0.577	0.618	0.660	0.742	0.824	
								3	53	59	65	70	76	82	87	99	110	
						25	11.8	1	53110	58749	64388	70027	75666	81305	86944	98222	109500	0.781
								2	0.448	0.493	0.537	0.582	0.627	0.672	0.716	0.806	0.896	
								3	49	54	59	65	70	75	80	91	101	
						26	12.2	1	50789	56209	61629	67049	72469	77889	83309	94149	104989	0.813
								2	0.484	0.532	0.581	0.629	0.678	0.726	0.774	0.871	0.968	
								3	45	50	55	59	64	69	74	84	93	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Ft.												In.
								1	48659	53879	59099	64319	69539	74759	79979	90419	......	
						27	12 7	2	0 522	0 574	0 626	0 679	0.731	0.783	0.835	0.940	......	0.844
								3	42	46	51	55	59	64	68	77	......	
								1	46657	51690	56723	61756	66789	71822	76855	......	......	
						28	13.2	2	0.561	0.618	0.674	0.730	0.786	0.842	0.898	......	......	0.875
								3	38	43	47	51	55	59	63	......	......	
								1	44795	49655	54515	59375	64235	69095	73955	......	......	
						29	13.6	2	0.602	0.662	0.722	0.783	0.843	0.903	0.963	......	......	0.906
								3	36	40	43	47	51	55	59	......	......	
20x26	19½x25½	497 25	26944 74	2113 31	131 20			1	43043	47741	52439	57137	61835	66533	......	......	......	
						30	14 1	2	0.644	0.709	0.773	0.838	0.902	0.967	......	......	......	0.938
		1 046	1.086	1.065	1.046			3	33	37	40	44	48	51	......	......	......	
								1	41401	45948	50495	55042	59589	......	......	......	......	
						31	14.6	2	0.688	0.757	0.826	0.895	0.964	......	......	......	......	0.969
								3	31	34	38	41	44	......	......	......	......	
								1	39941	44347	48753	53159	......	......	......	......	......	
						32	15.1	2	0.733	0.806	0.882	0.954	......	......	......	......	......	1.000
								3	29	32	35	38	......	......	......	......	......	
								1	38380	42651	46922	......	......	......	......	......	......	
						33	15.5	2	0.780	0.858	0.935	......	......	......	......	......	......	1.031
								3	27	30	33	......	......	......	......	......	......	

						34	16.0	1	36999	41145	45291	.....	.....	.....	.....	.....	.....	1.063
								2	0.828	0.911	0.993	.....	.....	.....	.....	.....	.....	
								3	25	28	31	.....	.....	.....	.....	.....	.....	
						35	16.5	1	35699	39728	.....	.....	.....	.....	.....	.....	.....	1.094
0x26	19½x25½	497.25	26944.74	2113.31	131.20			2	0.877	0.966	.....	.....	.....	.....	.....	.....	.....	
		1.046	1.086	1.065	1.046			3	24	26	.....	.....	.....	.....	.....	.....	.....	
						36	16.9	1	34387	.....	.....	.....	.....	.....	.....	.....	.....	1.125
								2	0.928	.....	.....	.....	.....	.....	.....	.....	.....	
								3	22	.....	.....	.....	.....	.....	.....	.....	.....	
						Multiplying Factor		1	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
								2	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	
						19	8.3	1	83511	92131	100751	109371	117991	126611	.....	.....	.....	0.594
								2	0.240	0.264	0.287	0.312	0.336	0.359	.....	.....	.....	
								3	94	104	114	123	133	143	.....	.....	.....	
								4	121	133	145	157	169	181	.....	.....	.....	
						20	8.7	1	79090	87282	95474	103666	111858	120050	128242	.....	.....	0.625
								2	0.266	0.292	0.319	0.345	0.372	0.399	0.425	.....	.....	
								3	85	94	102	111	120	129	137	.....	.....	
20x28	19½x27½	536.25	33794.90	2457.81	141.50			4	.....	.....	.....	.....	.....	.....	183	.....	.....	
		1.044	1.083	1.063	1.044	21	9.2	1	75029	82829	90629	98429	106229	114029	121829	.....	.....	0.656
								2	0.293	0.322	0.351	0.380	0.410	0.439	0.468	.....	.....	
								3	77	85	93	101	108	116	124	.....	.....	
						22	9.6	1	71338	78783	86228	93673	101118	108563	116008	.....	.....	0.688
								2	0.322	0.354	0.386	0.418	0.450	0.483	0.514	.....	.....	
								3	69	77	84	91	98	106	113	.....	.....	
						23	10.0	1	67976	75099	82222	89345	96468	103591	110714	124960	.....	0.719
								2	0.351	0.386	0.422	0.457	0.492	0.527	0.562	0.632	.....	
								3	63	70	77	83	90	97	103	116	.....	
								4	.....	.....	.....	.....	.....	.....	.....	179	.....	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section $A=bh$	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. in.	In.[4]	In.[3]	Lbs.	Ft.												In.
						24	10.5	1	64834	71657	78480	85303	92126	98949	105772	119418	......	0.750
								2	0.382	0.420	0.459	0.497	0 535	0.573	0.612	0.688	......	
								3	58	64	70	76	82	88	95	107	......	
						25	10 9	1	61991	68544	75097	81650	88203	94756	101309	114415	127521	0.781
								2	0.415	0.456	0.498	0.539	0.581	0.622	0.664	0.747	0.830	
								3	53	59	64	70	76	81	87	98	109	
								4	......	......	......	......	......	......	......	......	183	
20x28	19½x27½	536.25	33794 90	2457 81	141 50	26	11.3	1	59321	65621	71921	78221	84521	90821	97121	109721	122321	0.813
		1.044	1.083	1 063	1 044			2	0.449	0.493	0.538	0.583	0.628	0.673	0.718	0.807	0.897	
								3	49	54	59	64	70	75	80	90	101	
						27	11.8	1	56840	62906	68972	75038	81104	87170	93236	105368	117500	0.844
								2	0.484	0 532	0.581	0.629	0.678	0.726	0.774	0.872	0.968	
								3	45	50	55	60	64	69	74	84	93	
						28	12 2	1	54549	60400	66251	72102	77953	83804	89655	101357		0 875
								2	0 520	0 572	0 625	0 677	0 728	0 781	0 833	0 937		
								3	42	46	51	55	60	64	69	78		
						29	12 7	1	52388	58037	63686	69335	74984	80633	86282			0 906
								2	0.558	0.614	0.670	0 725	0.782	0.837	0 893			
								3	39	43	47	51	55	60	64			

20x28	$19\frac{1}{2}$x$27\frac{1}{2}$	536.25 1.044	33794.90 1.083	2457.81 1.063	141.50 1.044	30	13.1	1 2 3	50357 0.597 36	55817 0 657 40	61277 0 717 44	66737 0 777 48	72197 0.836 52	77657 0 896 55	83117 0 956 59			0.938
						31	13 5	1 2 3	48433 0.638 33	53715 0.702 37	5899[illegible] 0 766 41	64279 0.830 44	69561 0.893 48	74843 0.957 52				0.969
						32	14.0	1 2 3	46662 0.680 31	51781 0.748 35	56900 0 816 38	62019 0.883 42	67138 0.952 45					1.000
						33	14.4	1 2 3	44961 0.723 29	49924 0.795 32	54887 0.867 36	59850 0.939 39						1.031
						34	14 8	1 2 3	43380 0.767 27	48199 0.844 30	53018 0.921 33	57837 0.998 36						1 063
						35	15.3	1 2 3	41859 0.813 26	46540 0.895 29	51221 0.976 31							1 094
						36	15.7	1 2 3	40407 0.860 24	44957 0.946 27								1.125
						37	16.1	1 2 3	39055 0.909 23	43484 1.000 25								1.156
						38	16.6	1 2 3	37723 0.958 21									1.188
						Multiplying Factor		1 2 4	1.06 0.98 1.02	1.06 0.98 1.02	1.06 0.98 1 02	1.06 0 98 1.02	1.06 0.98 1.02	1.06 0.98 1.02	1.06 0.98 1 02	1 06 0.98 1.02	1.06 0.98 1.02	

(Table 20 Continued on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia $I=\frac{bh^3}{12}$	Section Modulus $S=\frac{bh^2}{6}$	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in Inches, for Unit Stresses in Pounds per Square Inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
20x30	19½x29½	575.25	41717.62	2828.31	151.80	20	8.1	1	91174	100595	110016	119437	128858	138279				0.625
		1 043	1 078	1 061	1 043			2	0.247	0.272	0.297	0.322	0.346	0.371				
								3	91	101	110	119	129	138				
								4	123	135	148	160	172	184				
						21	8.5	1	86592	95570	104548	113526	122504	131482				0.656
								2	0.273	0.300	0.327	0.355	0.382	0.410				
								3	82	91	100	108	117	125				
						22	9.0	1	82290	90853	99416	107979	116542	125105	133668			0.688
								2	0.299	0.329	0.359	0.389	0.419	0.449	0.479			
								3	75	83	90	98	106	114	122			
								4	......	......	......	......	......	......	179			
						23	9.4	1	78469	86665	94861	103057	111253	119449	127645			0.719
								2	0.327	0.360	0.393	0.426	0.458	0.491	0.524			
								3	68	75	82	90	97	104	111			
						24	9.8	1	74898	82752	90606	98460	106314	114168	122022	137730		0.750
								2	0.356	0.392	0.428	0.463	0.499	0.534	0.570	0.641		
								3	62	69	76	82	89	95	102	115		
								4	....	...	..					184		

						25	10.2	1	71597	79136	86675	94214	101753	109292	116831	131909	......	
								2	0.387	0 425	0.464	0.503	0.542	0.580	0.619	0.696	......	0.781
								3	57	63	69	75	81	87	93	106	......	
						26	10.6	1	68533	75781	83029	90277	97525	104773	112021	126517	.....	
								2	0.418	0.460	0.502	0.544	0.585	0.627	0.669	0.752	......	
								3	53	58	64	69	75	81	86	97	......	0.813
						27	11.0	1	65702	72682	79662	86642	93622	100602	107582	121542	125502	
								2	0.451	0.497	0.542	0.586	0.632	0.677	0.722	0.812	0.903	
								3	49	54	. 59	64	69	75	80	90	100	0 844
								4	....	......	......	......	......	......	......	......	182	
						28	11.4	1	63070	69802	76534	83266	89998	96730	103462	116926	130390	
								2	0 485	0.534	0.582	0.631	0.679	0.728	0.776	0.874	0.971	
								3	45	50	55	59	64	69	74	84	93	0.875
						29	11.8	1	60599	67099	73599	80099	86599	93099	99599	112599	.	
20x30	19½x29½	575.25	41717.62	2828.31	151.80			2	0.520	0.572	0.624	0.677	0.729	0.781	0.833	0.937	.	
		1.043	1.078	1.061	1.043			3	42	46	51	55	60	64	69	78	.	0.906
						30	12.2	1	58258	64539	70820	77101	83382	89663	95944	.....		
								2	0.556	0.612	0.668	0.724	0.779	0.835	0.890	......		
								3	39	43	47	51	56	60	64	.....		0.938
						31	12.6	1	56096	62176	68256	74336	80416	86496	92576	. . .	. .	
								2	0.595	0.654	0.714	0.773	0.832	0.892	0.952	. .	. .	
								3	36	40	44	48	52	56	60	. . .		0.969
						32	13.0	1	54023	59911	65799	71687	77575	83463	.....	. . .	. .	
								2	0.634	0.697	0.760	0.823	0.886	0.950	. . . .	.	.	
								3	34	37	41	45	48	52	. . .	. . .	. . .	1.000
						33	13.4	1	52122	57835	63548	69261	74974	.....	....	. . . .	. . . .	
								2	0.674	0.742	0.809	0.876	0.944	......	. . .	. . .		
								3	32	35	39	42	45	.....	. . . .	. . . .	. .	1.031
						34	13.8	1	50280	55824	61368	66912	. . .	. .	.....	......	.....	
								2	0.715	0.787	0.858	0.930	. . .	. . . .	. . . .	......	.	
								3	30	33	36	39	. .	. . . .	. . . .	.....	. . . .	1.063

(Table 20 Concluded on Next Page.)

TABLE 20—Continued.

For full explanation of this table see pages 68 to 70.

Size Rough	Size Surfaced S1S1E or S4S	Area Cross Section A=bh	Moment of Inertia I=bh³/12	Section Modulus S=bh²/6	Weight per Lineal Foot (Based on Green Timber at 38 lbs. per cu. ft.)	Span	Ratio of Span to Depth of Surfaced Timber l/h	Reference Number	Total Safe Loads in Pounds, and Maximum Deflections in inches, for Unit Stresses in Pounds per Square inch, as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000	Deflection equivalent to 1/32 Inch per Foot of Span D
In.	In.	Sq. In.	In.⁴	In.³	Lbs.	Ft.												In.
						35	14.2	1	48519	53902	59285	64668	......	......	......	......	......	1.094
								2	0.758	0.833	0.909	0.985	......	......	......	......	......	
								3	28	31	34	37	......	......	......	......	......	
						36	14.6	1	46908	52145	57382	......	......	......	......	......	......	1.125
								2	0.802	0.882	0.963	......	......	......	......	......	......	
								3	26	29	32	......	......	......	......	......	......	
						37	15.1	1	45334	50429	......	......	......	......	......	......	......	1.156
20x30	19½x29½	575.25	41717.62	2828.31	151.80			2	0.847	0.932	......	......	......	......	......	......	......	
								3	25	27	......	......	......	......	......	......	......	
		1.043	1.078	1.061	1.043	38	15.5	1	43834	48794	......	......	......	......	......	......	......	1.188
								2	0.893	0.982	......	......	......	......	......	......	......	
								3	23	26	......	......	......	......	......	......	......	
						39	15.9	1	42401	......	......	......	......	......	......	......	......	1.219
								2	0.941	......	......	......	......	......	......	......	......	
								3	22	......	......	......	......	......	......	......	......	
						Multiplying Factor		1	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
								2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	
								4	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

SAFE TOTAL LOADS FOR BEAMS, LIMITED BY HORIZONTAL SHEAR—ALSO SAFE VERTICAL SHEAR

Table 21 has been computed to show the safe loads on beams determined by the resistance to horizontal shear. Shearing values varying from 100 to 225 pounds per square inch have been used and are computed for beams surfaced S1S1E or S4S. If desirable to find the corresponding values for full size beams (rough) multiply loads in any horizontal line in the table by the factor given in bold face type in the column headed "Multiplying Factor."

Example: To find the load on a 12″x18″ rough timber limited by a horizontal shear of 100 pounds per square inch. The table shows such a load to be 26,830 pounds for a beam surfaced to standard size. Multiply 26,830 by 1.07, shown in bold face type in the column headed "Multiplying Factor," and the limiting load required for a full size timber is found to be 28,710 pounds.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR DOUGLAS FIR BEAMS—DETERMINED BY RESISTANCE TO HORIZONTAL SHEAR

Safe Load in pounds $= W = \dfrac{Jbh}{0.75}$, shown in light face type.

Also

SAFE VERTICAL SHEAR IN POUNDS FOR DOUGLAS FIR BEAMS—DETERMINED BY RESISTANCE TO HORIZONTAL SHEAR

Safe Vertical Shear in pounds $= \dfrac{W}{2} = V = \dfrac{Jbh}{1.50}$, shown in italics.

Values in this table are based on surfaced sizes. To get values for rough sizes, multiply factor for any given size by number in bold face type.

TABLE 21

* See page 34

Size: Rough In.	Size: Surfaced S1S1E or S4S In.	Multiplying Factor	Total Safe Loads and Safe Vertical Shear in Pounds Limited by Horizontal Shear in Pounds per Square Inch as Indicated: 100	R. R. 120* Structures	125	Highway 150* Structures	Protected 175* Structures	200	225
2x 4	1⅝x 3⅝	**1.36**	785	942	981	1178	1374	1570	1766
			393	*471*	*491*	*589*	*687*	*785*	*883*
2x 6	1⅝x 5⅝	**1.31**	1219	1463	1524	1828	2133	2438	2743
			610	*732*	*762*	*914*	*1067*	*1219*	*1372*
2x 8	1⅝x 7½	**1.31**	1625	1950	2031	2438	2844	3250	3656
			813	*975*	*1016*	*1219*	*1422*	*1625*	*1828*
2x10	1⅝x 9½	**1.30**	2059	2470	2574	3089	3603	4118	4633
			1030	*1235*	*1287*	*1545*	*1802*	*2059*	*2317*
2x12	1⅝x11½	**1.29**	2491	2990	3114	3737	4359	4982	5605
			1246	*1495*	*1557*	*1869*	*2180*	*2491*	*2803*
2x14	1⅝x13½	**1.28**	2925	3510	3656	4388	5119	5850	6581
			1463	*1755*	*1828*	*2194*	*2560*	*2925*	*3291*
2x16	1⅝x15½	**1.27**	3359	4030	4199	5039	5878	6718	7558
			1680	*2015*	*2100*	*2520*	*2939*	*3359*	*3779*
2x18	1⅝x17½	**1.27**	3791	4550	4739	5687	6634	7582	8530
			1896	*2275*	*2370*	*2844*	*3317*	*3791*	*4265*
3x 6	2½x 5½	**1.31**	1834	2200	2293	2751	3210	3668	4127
			917	*1100*	*1147*	*1376*	*1605*	*1834*	*2064*
3x 8	2½x 7½	**1.28**	2500	3000	3125	3750	4375	5000	5625
			1250	*1500*	*1563*	*1875*	*2188*	*2500*	*2813*
3x10	2½x 9½	**1.26**	3168	3800	3960	4752	5544	6336	7128
			1584	*1900*	*1980*	*2376*	*2772*	*3168*	*3564*
3x12	2½x11½	**1.25**	3833	4600	4791	5750	6708	7666	8624
			1917	*2300*	*2396*	*2875*	*3354*	*3833*	*4312*
3x14	2½x13½	**1.25**	4500	5400	5625	6750	7875	9000	10125
			2250	*2700*	*2813*	*3375*	*3938*	*4500*	*5063*
3x16	2½x15½	**1.24**	5167	6200	6459	7751	9042	10334	11626
			2584	*3100*	*3230*	*3876*	*4521*	*5167*	*5813*
3x18	2½x17½	**1.23**	5835	7000	7294	8753	10211	11670	13129
			2918	*3500*	*3647*	*4377*	*5106*	*5835*	*6565*
4x 4	3½x 3½	**1.31**	1633	1960	2041	2450	2858	3266	3674
			817	*980*	*1021*	*1225*	*1429*	*1633*	*1837*
4x 6	3½x 5½	**1.25**	2567	3080	3209	3851	4492	5134	5776
			1284	*1540*	*1605*	*1926*	*2246*	*2567*	*2888*

(Table 21 Continued on Next Page.)

TABLE 21—Continued.

Size: Rough In.	Size: Surfaced S1S1E or S4S In.	Multiplying Factor	100	R. R. 120* Structures	125	Highway 150* Structures	Protected 175* Structures	200	225
			Total Safe Loads and Safe Vertical Shear in Pounds Limited by Horizontal Shear in Pounds per Square Inch as Indicated						
4x 8	3½x 7½	1.22	3500 *1750*	4200 *2100*	4375 *2188*	5250 *2625*	6125 *3063*	7000 *3500*	7875 *3938*
4x10	3½x 9½	1.20	4432 *2216*	5320 *2660*	5540 *2770*	6648 *3324*	7756 *3878*	8864 *4432*	9972 *4986*
4x12	3½x11½	1.19	5368 *2684*	6440 *3220*	6710 *3355*	8052 *4026*	9394 *4697*	10736 *5368*	12078 *6039*
4x14	3½x13½	1.19	6300 *3150*	7560 *3780*	7875 *3938*	9450 *4725*	11025 *5513*	12600 *6300*	14175 *7088*
4x16	3½x15½	1.18	7234 *3617*	8680 *4340*	9043 *4522*	10851 *5426*	12660 *6330*	14468 *7234*	16277 *8139*
4x18	3½x17½	1.18	8165 *4083*	9800 *4900*	10206 *5103*	12248 *6124*	14289 *7145*	16330 *8165*	18371 *9186*
6x 6	5½x 5½	1.19	4067 *2034*	4880 *2440*	5084 *2542*	6101 *3051*	7117 *3559*	8134 *4067*	9151 *4576*
6x 8	5½x 7½	1.16	5500 *2750*	6600 *3300*	6875 *3438*	8250 *4125*	9625 *4813*	11000 *5500*	12375 *6188*
6x10	5½x 9½	1.15	6965 *3483*	8360 *4180*	8706 *4353*	10448 *5224*	12189 *6095*	13930 *6965*	15671 *7836*
6x12	5½x11½	1.14	8435 *4218*	10120 *5060*	10544 *5272*	12653 *6327*	14761 *7381*	16870 *8435*	18979 *9490*
6x14	5½x13½	1.13	9900 *4950*	11880 *5940*	12375 *6188*	14850 *7425*	17325 *8663*	19800 *9900*	22275 *11138*
6x16	5½x15½	1.13	11366 *5683*	13650 *6825*	14208 *7104*	17049 *8525*	19891 *9946*	22732 *11366*	25574 *12787*
6x18	5½x17½	1.12	12835 *6418*	15400 *7800*	16044 *8022*	19253 *9627*	22461 *11231*	25670 *12835*	28879 *14440*
6x20	5½x19½	1.12	14300 *7150*	17160 *8580*	17875 *8938*	21450 *10725*	25025 *12513*	28600 *14300*	32175 *16088*
8x 8	7½x 7½	1.14	7500 *3750*	9000 *4500*	9375 *4688*	11250 *5625*	13125 *6563*	15000 *7500*	16875 *8438*
8x10	7½x 9½	1.12	9500 *4750*	11400 *5700*	11875 *5938*	14250 *7125*	16625 *8313*	19000 *9500*	21375 *10688*
8x12	7½x11½	1.11	11500 *5750*	13800 *6900*	14375 *7188*	17250 *8625*	20125 *10063*	23000 *11500*	25875 *12938*
8x14	7½x13½	1.11	13500 *6750*	16200 *8100*	16875 *8438*	20250 *10125*	23625 *11813*	27000 *13500*	30375 *15188*
8x16	7½x15½	1.10	15500 *7750*	18600 *9300*	19375 *9688*	23250 *11625*	27125 *13563*	31000 *15500*	34875 *17438*
8x18	7½x17½	1.10	17500 *8750*	21000 *10500*	21875 *10938*	26250 *13125*	30625 *15313*	35000 *17500*	39375 *19688*
8x20	7½x19½	1.09	19500 *9750*	23400 *11700*	24375 *12188*	29250 *14625*	34125 *17063*	39000 *19500*	43875 *21938*
10x10	9½x 9½	1.11	12037 *6019*	14450 *7225*	15046 *7523*	18056 *9028*	21065 *10533*	24074 *12037*	27083 *13542*
10x12	9½x11½	1.10	14568 *7284*	17490 *8745*	18210 *9105*	21852 *10926*	25494 *12747*	29136 *14568*	32778 *16389*
10x14	9½x13½	1.09	17100 *8550*	20520 *10260*	21375 *10688*	25650 *12825*	29925 *14963*	34200 *17100*	38475 *19238*
10x16	9½x15½	1.09	19640 *9820*	23570 *11785*	24550 *12275*	29460 *14730*	34370 *17185*	39280 *19640*	44190 *22095*
10x18	9½x17½	1.08	22170 *11085*	26600 *13300*	27713 *13857*	33255 *16628*	38798 *19399*	44340 *22170*	49883 *24942*
10x20	9½x19½	1.08	24700 *12350*	29640 *14820*	30875 *15438*	37050 *18525*	43225 *21613*	49400 *24700*	55575 *27788*

(Table 21 Concluded on Next Page.)

TABLE 21—Continued.

Size		Multiplying Factor	Total Safe Loads and Safe Vertical Shear in Pounds Limited by Horizontal Shear in Pounds per Square Inch as Indicated						
Rough	Surfaced S1S1E or S4S		100	R. R. 120* Structures	125	Highway 150* Structures	Protected 175* Structures	200	225
In.	In.								
12x12	11½x11½	1.09	17640	21160	22050	26460	30870	35280	39690
			8820	*10580*	*11025*	*13230*	*15435*	*17640*	*19845*
12x14	11½x13½	1.08	20700	24830	25875	31050	36225	41400	46575
			10350	*12415*	*12938*	*15525*	*18113*	*20700*	*23288*
12x16	11½x15½	1.08	23770	28520	29713	35655	41598	47540	53483
			11885	*14260*	*14857*	*17828*	*20799*	*23770*	*26742*
12x18	11½x17½	1.07	26830	32200	33538	40245	46958	53660	60368
			13415	*16100*	*16769*	*20123*	*23479*	*26830*	*30184*
12x20	11½x19½	1.07	29900	35890	37375	44850	52325	59800	67275
			14950	*17945*	*18688*	*22425*	*26163*	*29900*	*33638*
14x14	13½x13½	1.08	24300	29170	30375	36450	42525	48600	54675
			12150	*14585*	*15188*	*18225*	*21263*	*24300*	*27338*
14x16	13½x15½	1.07	27900	33490	34875	41850	48825	55800	62775
			13950	*16745*	*17438*	*20925*	*24413*	*27900*	*31388*
14x18	13½x17½	1.07	31500	37800	39375	47250	55125	63000	70875
			15750	*18900*	*19688*	*23625*	*27563*	*31500*	*35438*
14x20	13½x19½	1.06	35100	42110	43875	52650	61425	70200	78975
			17550	*21055*	*21938*	*26325*	*30713*	*35100*	*39488*
16x16	15½x15½	1.07	32030	38430	40038	48045	56053	64060	72068
			16015	*19215*	*20019*	*24023*	*28027*	*32030*	*36034*
16x18	15½x17½	1.06	36170	43400	45213	54255	63298	72340	81383
			18085	*21700*	*22607*	*27128*	*31649*	*36170*	*40692*
16x20	15½x19½	1.06	40300	48350	50375	60450	70525	80600	90675
			20150	*24175*	*25188*	*30225*	*35263*	*40300*	*45338*
16x22	15½x21½	1.06	44420	53300	55525	66630	77735	88840	99945
			22210	*26650*	*27763*	*33315*	*38868*	*44420*	*49973*
16x24	15½x23½	1.05	48580	58270	60725	72870	85015	97160	109305
			24290	*29135*	*30363*	*36435*	*42508*	*48580*	*54653*
18x18	17½x17½	1.06	40820	48990	51025	61230	71435	81640	91845
			20410	*24495*	*25513*	*30615*	*35718*	*40820*	*45923*
18x20	17½x19½	1.06	45500	54600	56875	68250	79625	91000	102375
			22750	*27300*	*28438*	*34125*	*39813*	*45500*	*51188*
18x22	17½x21½	1.05	50180	60200	62725	75270	87815	100360	112905
			25090	*30100*	*31363*	*37635*	*43908*	*50180*	*56453*
18x24	17½x23½	1.05	54810	65800	68513	82215	95918	109620	123323
			27405	*32900*	*34257*	*41108*	*47959*	*54810*	*61662*
18x26	17½x25½	1.05	59500	71400	74375	89250	104125	119000	133875
			29750	*35700*	*37188*	*44625*	*52063*	*59500*	*66938*
20x20	19½x19½	1.05	50700	60820	63375	76050	88725	101400	114075
			25350	*30410*	*31688*	*38025*	*44363*	*50700*	*57038*
20x22	19½x21½	1.05	55880	67070	69850	83820	97790	111760	125730
			27940	*33535*	*34925*	*41910*	*48895*	*55880*	*62865*
20x24	19½x23½	1.05	61080	73300	76350	91620	106890	122160	137430
			30540	*36650*	*38175*	*45810*	*53445*	*61080*	*68715*
20x26	19½x25½	1.05	66270	79550	82838	99405	115973	132540	149108
			33135	*39775*	*41419*	*49703*	*57987*	*66270*	*74554*
20x28	19½x27½	1.04	71460	85750	89325	107190	125055	142920	160785
			35730	*42875*	*44663*	*53595*	*62528*	*71460*	*80393*
20x30	19½x29½	1.04	76680	92000	95850	115020	134190	153360	172530
			38340	*46000*	*47925*	*57510*	*67095*	*76680*	*86265*

MAXIMUM SPANS AND MAXIMUM DEFLECTIONS FOR MILL AND LAMINATED FLOORS

Tables 22 and 23 show the maximum spans for both mill and laminated floors limited by safe fiber stresses varying from 1,200 to 1,800 pounds per square inch, and by floor loads varying from 50 to 1,000 pounds per square foot. The maximum deflections in inches are also given for each span length shown. The dimensions of flooring given are standard as manufactured by the West Coast Lumbermen's Association. The weight of the floor has been added to the live load in computing the spans and deflections. A value of 1,643,000 pounds per square inch for the modulus of elasticity was used in computing deflections in mill and laminated floors.

MAXIMUM SPANS AND MAXIMUM DEFLECTIONS FOR MILL FLOORS UNIFORMLY LOADED

TABLE 22

Values in this table are based on surfaced sizes.

Floor Thickness		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Square Foot (Based on air-dry weight at 34 lbs. per cu. ft.)	Live Load per Square Foot	Combined Load Live and Weight of Floor per sq. ft.	Maximum Spans in Feet and Maximum Deflections in Inches, for Safe Fiber Stresses in Pounds per Sq. In., as indicated					
Rough	Surfaced S1S1E or S4S	A=bh b=12 In.	$I=\frac{bh^3}{12}$ b=12 In.	$S=\frac{bh^2}{6}$ b=12 In.			L′	1200	1300	1400	1500	1600	1800
In.	In.	Sq. In.	In.[4]	In.[3]	Lbs.	Lbs.	Lbs.						
2½	2⅛	25.5	9.60	9.03	6.02	100	106.02	8′ 3″ .7019	8′ 7″ .8228	8′11″ .9562	....	....	....
						150	156.02	6′10″ .4812	7′ 1″ .5601	7′ 4″ .6463	7′ 7″ .7410	7′10″ .8420	....
						200	206.02	5′11″ .3607	6′ 2″ .4250	6′ 5″ .4950	6′ 7″ .5585	6′10″ .6412	7′ 3″ .8122
						250	256.02	5′ 4″ .2930	5′ 6″ .3378	5′ 9″ .3975	5′11″ .4511	6′ 2″ .5230	6′ 6″ 6530.
3½	3⅛	37.5	30.52	19.53	8.85	150	158.85	9′11″ .6887	10′ 4″ 8100	10′ 9″ .9445	....	....	....
						200	208.85	8′ 8″ .5266	9′ 0″ .6140	9′ 4″ .7118	9′ 8″ .8187	10′ 0″ .9328	....
						250	258.85	7′ 9″ 4211	8′ 1″ 4955	8′ 5″ .5784	8′ 8″ .6580	9′ 0″ .7562	9′ 6″ .9480
						300	308.85	7′ 1″ .3520	7′ 5″ .4171	7′ 8″ .4807	7′11″ .5481	8′ 3″ .6353	8′ 9″ .8044
						350	358.85	6′ 7″ .3037	6′10″ .3541	7′ 1″ .4099	7′ 4″ 4702	7′ 7″ .5366	8′ 1″ .6865
						400	408.85	6′ 2″ .2664	6′ 5″ .3123	6′ 8″ .3635	6′11″ .4191	7′ 2″ .4801	7′ 7″ .6043
						450	458.85	5′10″ .2382	6′ 1″ .2812	6′ 4″ .3280	6′ 6″ .3695	6′ 9″ .4255	7′ 2″ .5398
						500	508.85	5′ 7″ 2186	5′ 9″ .2511	6′ 0″ .2940	6′ 2″ .3331	6′ 5″ .3845	6′ 9″ .4785
						600	608.85	5′ 1″ .1815	5′ 3″ .2091	5′ 6″ .2474	5′ 8″ .2809	5′10″ .3175	6′ 2″ .3999
						700	708.85	4′ 8″ .1524	4′11″ .1837	5′ 1″ .2112	5′ 3″ 2410	5′ 5″ 2740	5′ 9″ .3476

TABLE 22—Continued.

Floor Thickness: Rough	Floor Thickness: Surfaced S1S1E or S4S	Area Cross Section $A=bh$ $b=12$ In.	Moment of Inertia $I=\frac{bh^3}{12}$ $b=12$ In.	Section Modulus $S=\frac{bh^2}{6}$ $b=12$ In.	Weight per Square Foot (Based on air-dry weight at 34 lbs. per cu. ft.)	Live Load per Square Foot	Combined Load Live and Weight of Floor per sq. ft. L′	Maximum Spans in Feet and Maximum Deflections in Inches, for Safe Fiber Stresses in Pounds per Sq. In., as indicated: 1200	1300	1400	1500	1600	1800
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Lbs.	Lbs.						
						150	160.27	11′ 6″ .7997	11′11″ .9294	....	....	....	....
						200	210.27	10′ 0″ .6040	10′ 5″ .7102	10′10″ .8261	11′ 2″ .9417	....	....
						250	260.27	9′ 0″ .4895	9′ 4″ .5700	9′ 8″ .6583	10′ 1″ .7679	10′ 5″ .8748	....
						300	310.27	8′ 3″ .4110	8′ 7″ .4820	8′11″ .5599	9′ 2″ .6340	9′ 6″ .7266	10′ 1″ .9203
						350	360.27	7′ 8″ .3550	7′11″ .4100	8′ 3″ .4795	8′ 6″ .5457	8′10″ .6282	9′ 4″ .7892
						400	410.27	7′ 2″ .3105	7′ 5″ .3601	7′ 9″ .4234	8′ 0″ .4831	8′ 3″ .5480	8′ 9″ .6940
4*	3⅝	43.5	47.63	26.27	10.27	450	460.27	6′ 9″ .2751	7′ 0″ .3208	7′ 4″ .3790	7′ 7″ .4348	7′10″ .4947	8′ 3″ .6175
						500	510.27	6′ 5″ .2486	6′ 8″ .2912	6′11″ .3371	7′ 2″ .3882	7′ 5″ .4431	7′10″ .5560
						600	610.27	5′10″ .2056	6′ 1″ .2429	6′ 4″ .2830	6′ 7″ .3279	6′ 9″ .3671	7′ 2″ .4659
						700	710.27	5′ 5″ .1772	5′ 8″ .2105	5′11″ .2466	6′ 1″ .2800	6′ 3″ .3149	6′ 8″ .4029
						800	810.27	5′ 1″ .1559	5′ 4″ .1862	5′ 6″ .2134	5′ 8″ .2428	5′11″ .2819	6′ 3″ .3538

*Use this table for laminated floors of 2″x4″ lumber.

MAXIMUM SPANS AND MAXIMUM DEFLECTIONS FOR LAMINATED FLOORS UNIFORMLY LOADED

TABLE 23

Values in this table are based on surfaced sizes.

Floor Thickness		Area Cross Section	Moment of Inertia	Section Modulus	Weight per Square Foot (Based on air-dry weight at 34 lbs. per cu. ft.)	Live Load per Square Foot	Combined Load Live and Weight of Floor per Sq. Ft.	Maximum Spans in Feet and Maximum Deflections in Inches, for Safe Fiber Stresses in Pounds per Sq. In., as indicated					
Rough	Surfaced S1S1E or S4S	$A=bh$ b=12 In.	$I=\frac{bh^3}{12}$ b=12 In.	$S=\frac{bh^2}{6}$ b=12 In.			L′	1200	1300	1400	1500	1600	1800
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Lbs.	Lbs.						
6	5⅝	67.5	177.98	63.28	15.95	300	315.95	12′ 8″ .6258	13′ 2″ .7326	13′ 8″ .8500	14′ 2″ .9780	....	....
						350	365.95	11′ 9″ .5380	12′ 3″ .6336	12′ 8″ .7298	13′ 2″ .8440	13′ 7″ .9580	....
						400	415.95	11′ 0″ .4716	11′ 6″ .5583	11′11″ .6458	12′ 4″ .7407	12′ 9″ .8444	....
						450	465.95	10′ 5″ .4231	10′10″ .4955	11′ 3″ .5759	11′ 8″ .6637	12′ 0″ .7482	12′ 9″ 9500
						500	515.95	9′11″ .3832	10′ 4″ .4509	10′ 8″ .5174	11′ 1″ .5980	11′ 5″ .6778	12′ 2″ .8657
						600	615.95	9′ 1″ .3217	9′ 5″ .3742	9′10″ .4397	10′ 2″ .5035	10′ 6″ 5727	11′ 1″ .7180
						700	715.95	8′ 5″ .2761	8′ 9″ .3231	9′ 1″ .3754	9′ 5″ .4320	9′ 9″ 4940	10′ 4″ .6239
						800	815.95	7′11″ .2441	8′ 2″ .2817	8′ 6″ .3289	8′10″ .3801	9′ 1″ 4289	9′ 8″ .5460
						900	915.95	7′ 5″ 2142	7′ 9″ .2534	8′ 0″ .2909	8′ 4″ .3381	8′ 7″ .3830	9′ 1″ .4825
						1000	1015.95	7′ 1″ .1955	7′ 4″ .2269	7′ 7″ .2615	7′11″ .3049	8′ 2″ 3462	8′ 8″ .4390

						350	371.25	15′ 7″ 7102	16′ 3″ .8369	16′10″ .9670			
						400	421.25	14′ 7″ 6220	15′ 3″ .7370	15′ 9″ .8466	16′ 4″ 9751		
						450	471.25	13′10″ .5592	14′ 5″ .6580	14′11″ .7589	15′ 5″ 8683	15′11″ 9879	
						500	521.25	13′ 2″ .5071	13′ 8″ .5920	14′ 2″ .6853	14′ 8″ 7871	15′ 2″ 8973	....
8	7½	90.0	421.88	112.50	21.25	600	621.25	12′ 1″ .4271	12′ 6″ .4955	13′ 0″ .5766	13′ 6″ 6661	13′11″ .7555	14′ 9″ 9545
						700	721.25	11′ 2″ .3650	11′ 8″ .4319	12′ 1″ .4979	12′ 6″ 5717	12′11″ 6510	13′ 8″ 8200
						800	821.25	10′ 6″ .3226	10′11″ .3775	11′ 4″ .4384	11′ 8″ .4978	12′ 1″ .5692	12′10″ 7220
						900	921.25	9′11″ 2875	10′ 3″ 3330	10′ 8″ 3882	11′ 1″ 4491	11′ 5″ 5086	12′ 1″ 6404
						1000	1021.25	9′ 5″ .2596	9′ 9″ .3011	10′ 2″ .3529	10′ 6″ .4030	10′10″ .4574	11′ 6″ .5803
						450	476.91	17′ 5″ 7002	18′ 1″ 8171	18′10″ .9540	....	...	
						500	526.91	16′ 7″ .6345	17′ 3″ .7438	17′11″ .8639	18′ 6″ .9870	......	...
						600	626.91	15′ 2″ .5309	15′10″ .6262	16′ 5″ .7259	17′ 0″ .8339	17′ 6″ 9422	...
10	9½	114.0	857.38	180.50	26.91	700	726.91	14′ 1″ .4572	14′ 8″ .5380	15′ 3″ .6259	15′ 9″ .7154	16′ 3″ 8120	....
						800	826.91	13′ 3″ .4049	13′ 9″ .4720	14′ 3″ .5460	14′ 9″ .6266	15′ 3″ .7142	16′ 2″ 9033
						900	926.91	12′ 6″ .3605	13′ 0″ .4223	13′ 6″ .4908	13′11″ 5582	14′ 5″ 6394	15′ 3″ 8043
						1000	1026.91	11′10″ .3231	12′ 4″ 3801	12′10″ .4431	13′ 3″ .5062	13′ 8″ 5750	14′ 6″ .7280

(Table 23 Concluded on Next Page.)

TABLE 23—Continued.

Floor Thickness Rough	Floor Thickness Surfaced S1S1E or S4S	Area Cross Section $A=bh$ $b=12$ In.	Moment of Inertia $I=\frac{bh^3}{12}$ $b=12$ In.	Section Modulus $S=\frac{bh^2}{6}$ $b=12$ In.	Weight per Square Foot (Based on air-dry weight at 34 lbs. per cu. ft.)	Live Load per Square Foot	Combined Load Live and Weight of Floor per Sq. Ft. L'	Maximum Spans in Feet and Maximum Deflections in Inches, for Safe Fiber Stresses in Pounds per Sq. In., as indicated: 1200	1300	1400	1500	1600	1800
In.	In.	Sq. In.	In.^{4}	In.^{3}	Lbs.	Lbs.	Lbs.						
12	$11\frac{1}{2}$	138.0	1520 88	264.50	32 59	600	632.59	18′ 4″ .6404	19′ 0″ .7455	19′ 9″ .8669	20′ 5″ .9939	....	....
						700	732.59	17′ 0″ .5506	17′ 8″ .6441	18′ 4″ .7466	19′ 0″ .8594	19′ 8″ .9820	....
						800	832 59	15′11″ .4831	16′ 7″ .5680	17′ 3″ .6621	17′10″ .7579	18′ 5″ .8623	....
						900	932.59	15′ 1″ .4339	15′ 8″ .5069	16′ 3″ .5877	16′10″ .6751	17′ 5″ .7709	18′ 5″ .9700
						1000	1032.59	14′ 4″ .3919	14′11″ .4598	15′ 6″ .5341	16′ 0″ .6100	16′ 6″ .6920	17′ 6″ .8758
14	$13\frac{1}{2}$	162.0	2460 38	364 50	38 25	700	738.25	19′10″ .6381	20′ 8″ .7503	21′ 5″ .8683	....	....	....
						800	838.25	18′ 8″ .5760	19′ 5″ .6631	20′ 2″ .7700	20′10″ .8800	21′ 6″ 1.0000	....
						900	938.25	17′ 8″ .5063	18′ 4″ .5909	19′ 0″ .6836	19′ 8″ .7843	20′ 4″ .8942	....
						1000	1038 25	16′ 9″ 4552	17′ 5″ .5338	18′ 1″ .6184	18′ 9″ .7127	19′ 4″ .8080	....

MAXIMUM BENDING OR RESISTING MOMENTS OF CROSS SECTION IN FOOT POUNDS FOR RECTANGULAR BEAMS

Table 24 shows the maximum resisting moments in foot pounds for timbers varying in size from 2″x4″ to 20″x30″ for safe fiber stresses varying from 1,000 to 2,000 pounds per square inch. The values given are for surfaced sizes. Multiplying factors are given which enable the values to be quickly converted to those for rough timbers full size.

MAXIMUM BENDING OR RESISTING MOMENTS OF CROSS SECTION IN FOOT POUNDS FOR RECTANGULAR BEAMS

Values in this table are based on surfaced sizes. To get values for rough sizes, multiply Resisting Moment for any given size by multiplying factor in bold face in same horizontal line.

TABLE 24

Size		Multiplying Factor	Resisting Moments in Foot Pounds for Safe Fiber Stresses in Pounds per Sq. In., as indicated								
Rough	Surfaced S1S1E or S4S		1000	1100	1200	1300	1400	1500	1600	1800	2000
In.	In.										
2x 4	1⅝x 3⅝	**1.50**	297	327	356	386	416	446	475	535	594
2x 6	1⅝x 5⅝	**1.40**	714	785	857	928	1000	1071	1142	1285	1428
2x 8	1⅝x 7½	**1.40**	1269	1396	1523	1650	1777	1904	2030	2284	2538
2x10	1⅝x 9½	**1.36**	2037	2241	2444	2648	2852	3056	3259	3667	4074
2x12	1⅝x11½	**1.34**	2985	3284	3582	3881	4179	4478	4776	5373	5970
2x14	1⅝x13½	**1.32**	4113	4524	4936	5347	5758	6170	6581	7403	8226
2x16	1⅝x15½	**1.31**	5423	5965	6507	7050	7592	8135	8677	9761	10846
2x18	1⅝x17½	**1.30**	6912	7603	8294	8986	9677	10368	11059	12442	13824
3x 6	2½x 5½	**1.43**	1050	1155	1260	1365	1470	1575	1680	1890	2100
3x 8	2½x 7½	**1.37**	1952	2147	2342	2538	2733	2928	3123	3514	3904
3x10	2½x 9½	**1.33**	3134	3447	3761	4074	4388	4701	5014	5641	6268
3x12	2½x11½	**1.31**	4592	5051	5510	5970	6429	6888	7347	8266	9184
3x14	2½x13½	**1.29**	6328	6961	7594	8226	8859	9492	10125	11390	12656
3x16	2½x15½	**1.28**	8342	9176	10010	10845	11679	12513	13347	15016	16684
3x18	2½x17½	**1.27**	10633	11696	12760	13823	14886	15950	17013	19139	21266
4x 4	3½x 3½	**1.49**	596	656	715	775	834	894	954	1073	1192
4x 6	3½x 5½	**1.36**	1470	1617	1764	1911	2058	2205	2352	2646	2940
4x 8	3½x 7½	**1.30**	2734	3007	3281	3554	3828	4101	4374	4921	5468
4x10	3½x 9½	**1.27**	4388	4827	5265	5704	6143	6582	7021	7898	8776
4x12	3½x11½	**1.25**	6429	7072	7715	8358	9001	9644	10286	11572	12858
4x14	3½x13½	**1.23**	8859	9745	10631	11517	12403	13289	14174	15946	17718
4x16	3½x15½	**1.22**	11679	12847	14015	15183	16351	17519	18686	21022	23358
4x18	3½x17½	**1.21**	14888	16377	17865	19354	20843	22332	23821	26798	29776

TABLE 24—Continued.

Size: Rough In.	Size: Surfaced S1S1E or S4S In.	Multiplying Factor	Resisting Moments in Foot Pounds for Safe Fiber Stresses in Pounds per Sq. In., as indicated: 1000	1100	1200	1300	1400	1500	1600	1800	2000
6x 6	5½x 5½	1.30	2311	2542	2773	3004	3235	3467	3698	4160	4622
6x 8	5½x 7½	1.24	4297	4727	5156	5586	6016	6446	6875	7735	8594
6x10	5½x 9½	1.21	6894	7583	8273	8962	9652	10341	11030	12409	13788
6x12	5½x11½	1.19	10103	11113	12123	13134	14144	15155	16165	18185	20206
6x14	5½x13½	1.17	13922	15314	16706	18099	19491	20883	22275	25060	27844
6x16	5½x15½	1.16	18353	20188	22023	23859	25694	27530	29365	33035	36706
6x18	5½x17½	1.16	23394	25733	28073	30412	32752	35091	37430	42109	46788
6x20	5½x19½	1.15	29047	31952	34856	37761	40666	43571	46475	52285	58094
8x 8	7½x 7½	1.21	5859	6445	7031	7617	8203	8789	9374	10546	11718
8x10	7½x 9½	1.18	9401	10341	11281	12221	13161	14102	15042	16922	18802
8x12	7½x11½	1.16	13776	15154	16531	17909	19286	20664	22042	24797	27552
8x14	7½x13½	1.15	18984	20882	22781	24679	26578	28476	30374	34171	37968
8x16	7½x15½	1.14	25026	27529	30031	32534	35036	37539	40042	45047	50052
8x18	7½x17½	1.13	31901	35091	38281	41471	44661	47852	51042	57422	63802
8x20	7½x19½	1.12	39609	43570	47531	51492	55453	59414	63374	71296	79218
10x10	9½x 9½	1.17	11908	13099	14289	15480	16671	17862	19053	21434	23816
10x12	9½x11½	1.15	17450	19195	20940	22685	24430	26175	27920	31410	34900
10x14	9½x13½	1.13	24047	26452	28856	31261	33666	36071	38475	43285	48094
10x16	9½x15½	1.12	31700	34870	38040	41210	44380	47550	50720	57060	63400
10x18	9½x17½	1.11	40408	44449	48490	52530	56571	60612	64653	72734	80816
10x20	9½x19½	1.11	50172	55189	60206	65224	70241	75258	80275	90310	100344
12x12	11½x11½	1.14	21123	23235	25348	27460	29572	31685	33797	38021	42246
12x14	11½x13½	1.12	29109	32020	34931	37842	40753	43664	46574	52396	58218
12x16	11½x15½	1.11	38373	42210	46048	49885	53722	57560	61397	69071	76746
12x18	11½x17½	1.10	48915	53807	58698	63590	68481	73373	78264	88047	97830
12x20	11½x19½	1.10	60734	66807	72881	78954	85028	91101	97174	109321	121468

(Table 24 Concluded on Next Page.)

TABLE 24—Continued.

Size		Multiplying Factor	Resisting Moments in Foot Pounds for Safe Fiber Stresses in Pounds per Sq. In., as indicated								
Rough	Surfaced S1S1E or S4S		1000	1100	1200	1300	1400	1500	1600	1800	2000
In.	In.										
14x14	13½x13½	1.12	34172	37589	41006	44424	47841	51258	54675	61510	68344
14x16	13½x15½	1.11	45047	49552	54056	58561	63066	67571	72075	81085	90094
14x18	13½x17½	1.10	57422	63164	68906	74649	80391	86133	91875	103360	114844
14x20	13½x19½	1.09	71297	78427	85556	92686	99816	106946	114075	128335	142594
16x16	15½x15½	1.10	51720	56892	62064	67236	72408	77580	82752	93096	103440
16x18	15½x17½	1.09	65929	72522	79115	85708	92301	98894	105486	118672	131858
16x20	15½x19½	1.09	81859	90045	98231	106417	114603	122789	130974	147346	163718
16x22	15½x21½	1.08	99513	109464	119415	129367	139318	149270	159221	179123	199026
16x24	15½x23½	1.08	118888	130777	142665	154554	166443	178332	190221	213998	237776
18x18	17½x17½	1.09	74436	81880	89323	96767	104210	111654	119098	133985	148872
18x20	17½x19½	1.08	92422	101664	110906	120149	129391	138633	147875	166360	184844
18x22	17½x21½	1.08	112353	123588	134823	146059	157294	168530	179765	202235	224706
18x24	17½x23½	1.07	134228	147651	161073	174496	187919	201342	214765	241610	268456
18x26	17½x25½	1.07	158047	173852	189656	205461	221266	237071	252875	284485	316094
20x20	19½x19½	1.08	102984	113282	123581	133879	144178	154476	164774	185371	205968
20x22	19½x21½	1.07	125193	137712	150231	162751	175270	187790	200309	225347	250386
20x24	19½x23½	1.07	149568	164525	179481	194438	209395	224352	239309	269222	299136
20x26	19½x25½	1.07	176109	193720	211331	228942	246553	264164	281774	316996	352218
20x28	19½x27½	1.06	204818	225300	245781	266263	286745	307227	327709	368672	409636
20x30	19½x29½	1.06	235693	259262	282831	306401	329970	353540	377109	424247	471386

SAFE LOADS ON COLUMNS

In computing safe loads on columns two standard formulae have been used, one a straight line formula adopted by the American Railway Engineering Association, and the other a curved line formula established by the U. S. Department of Agriculture, Division of Forestry*. In both formulae safe fiber stresses in end compression have been used varying from 1,000 to 1,600 pounds per square inch.

* Now U. S. Dept. of Agriculture, Forest Service.

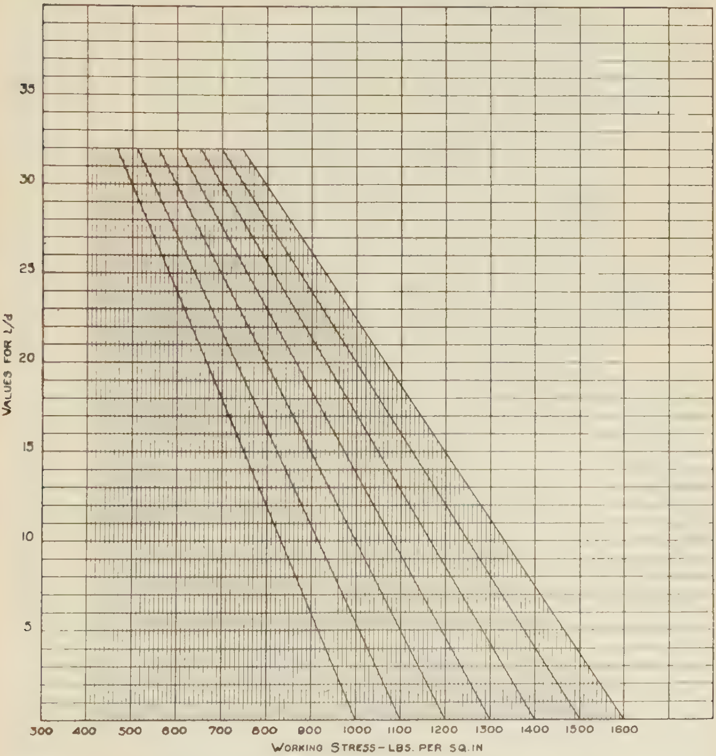


Diagram 14. Graphic presentation of column formula adopted by the American Railway Engineering Association for safe fiber stresses of 1,000 to 1,600 pounds per square inch. See table 25 for explanation of formula.

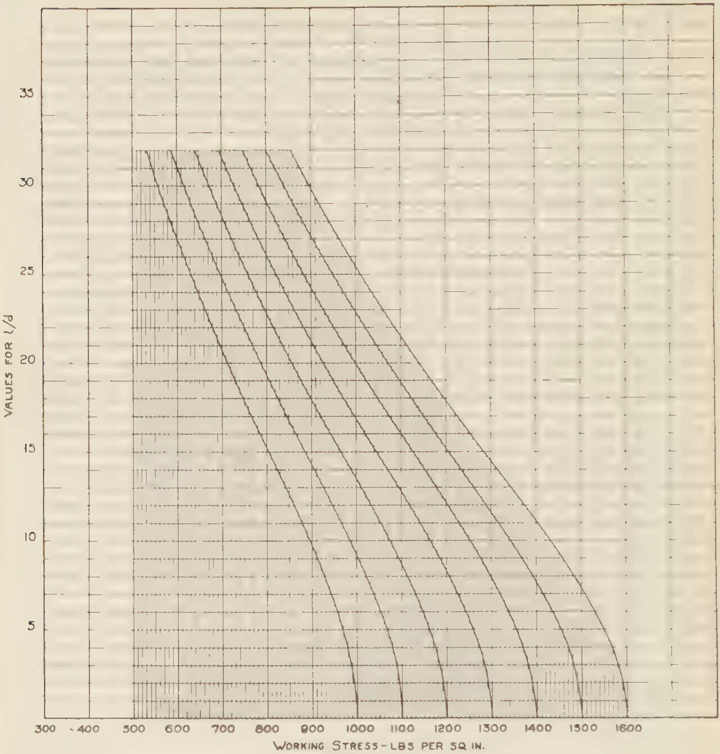


Diagram 15. Graphic presentation of column formula established by U. S. Dept. of Agriculture, Forestry Division (now U. S. Dept. of Agriculture, Forest Service), for safe fiber stresses of 1,000 to 1,600 pounds per square inch. See table 26 for explanation of formula.

FORMULA ADOPTED BY THE AMERICAN RAILWAY ENGINEERING ASSOCIATION

Working unit stress $= C\ (1 - l/60d)$ in pounds per square inch.

$C =$ Safe fiber stress in end compression, in pounds per square inch.

$l =$ Length of column, in inches.

$d =$ Least diameter or dimension of column, in inches.

FORMULA ESTABLISHED BY THE U. S. DEPT. OF AGRICULTURE, FORESTRY DIVISION*

$$\text{Working Unit Stress} = C\,\frac{(700+15c)}{(700+15c+c^2)}$$

C = Safe fiber stress in end compression, in pounds per square inch.
l = Length of column, in inches.
d = Least diameter or dimension of column, in inches.
c = l/d.

Diagrams 14 and 15 have been prepared and may be used for determining the working unit stresses for columns. The working unit stresses given in tables 25 and 26 have been taken directly from the diagrams and show in tabular form the corresponding safe fiber stresses for values of *l/d* varying from 15 to 32.

In the preparation of tables 27 and 28, the diagrams have been used *only for computing the total safe loads on columns in which the ratio of length to smallest dimension is 15 or greater.* In figuring the safe loads on columns in which l/d is less than 15 the working unit stresses in end compression shown at the top of tables have been used.

The tables show safe bearing loads for columns 6″x6″ to 26″x26″ in cross section, surfaced S1S1E or S4S. The area of the actual cross section is shown in square inches, together with the length of the column and the ratio l/d. Multiplying factors are also shown in bold face in these tables, and may be used in converting the various values shown, to similar values, for full size (rough) columns. The figures in the column headed "Multiplying Factor" apply to the loads shown in the same horizontal line. For example, the table based on the U. S. Department of Agriculture formula shows that by using a working unit stress of 1,600 pounds per square inch a 14″x14″ column 18 feet long, surfaced to 13½″x13½″, will support a load of 228,910 pounds. This same column in the rough size would support a load equal to 228,910x1.09 or 249,510 pounds.

* Now the U. S. Dept. of Agriculture, Forest Service.

WORKING UNIT STRESSES IN POUNDS PER SQUARE INCH FOR SQUARE END DOUGLAS FIR COLUMNS, SYMMETRICALLY LOADED

Based on the formula adopted by the American Railway Engineering Association.

Working Unit Stress = C (1—l/60d).

C = Safe fiber stress in end compression, in pounds per square inch.

l = length of column, in inches.

d = least side or diameter, in inches.

When l/d is less than 15, use "C."

TABLE 25

l/d	Working Unit Stresses in Pounds per Sq. In. for Values of "C" as indicated						
	1000	1100	1200	1300	1400	1500	1600
15	749	824	900	974	1049	1125	1200
16	732	806	879	952	1025	1100	1182
17	716	787	860	930	1002	1075	1145
18	700	769	840	909	979	1050	1119
19	683	750	819	887	955	1025	1092
20	666	732	800	866	932	1000	1065
21	649	714	779	843	909	975	1039
22	632	696	760	822	885	950	1012
23	616	677	739	801	862	925	985
24	600	659	720	779	839	900	959
25	582	640	699	757	815	875	932
26	566	622	680	735	792	850	906
27	549	604	659	714	769	825	879
28	533	585	639	692	746	800	852
29	516	567	620	670	722	775	825
30	500	548	599	649	699	750	799
31	483	530	580	627	675	725	772
32	466	512	559	606	651	700	745

WORKING UNIT STRESSES IN POUNDS PER SQUARE INCH FOR SQUARE END DOUGLAS FIR COLUMNS, SYMMETRICALLY LOADED

Based on formula established by the U. S. Dept. of Agriculture Forestry Division *

$$\text{Working Unit Stress} = C\frac{(700+15c)}{(700+15c+c^2)} \qquad c = l/d.$$

C = Safe fiber stress in end compression, in pounds per square inch.

l = length of column, in inches.

d = least side or diameter, in inches.

When l/d is less than 15, use "C."

TABLE 26

l/d	Working Unit Stresses in Pounds per Sq. In. for Values of "C" as indicated						
	1000	1100	1200	1300	1400	1500	1600
15	804	884	965	1046	1127	1206	1284
16	785	864	943	1022	1100	1179	1255
17	767	844	921	998	1075	1150	1226
18	749	823	899	974	1050	1124	1199
19	730	805	878	950	1025	1097	1170
20	712	786	857	928	1000	1071	1143
21	695	768	837	905	975	1046	1117
22	679	750	817	883	951	1020	1090
23	663	731	796	861	929	996	1063
24	647	714	778	841	906	971	1039
25	631	697	759	821	884	949	1013
26	617	681	741	802	864	927	989
27	601	664	724	784	844	905	965
28	587	648	707	766	824	883	942
29	573	632	690	748	805	862	920
30	559	617	674	730	787	841	899
31	547	601	659	713	768	821	878
32	534	587	643	696	750	801	856

* Now U. S. Dept. of Agriculture, Forest Service.

TABLE OF SAFE BEARING LOADS IN 1,000 POUND UNITS FOR SQUARE END DOUGLAS FIR COLUMNS, SYMMETRICALLY LOADED

Based on the formula adopted by the American Railway Engineering Association

Working Unit Stress = C $(1 - l/60d.)$
C = Safe fiber stress in end compression, in pounds per square inch.

l = length of column, in inches.
d = least side or diameter, in inches.
When l/d is less than 15, use "C."

Values in this table are based on surfaced sizes. To get values for rough sizes, multiply bearing load by multiplying factor in bold face in same horizontal line. To get cross-section of rough size, multiply area given by factor in bold face directly below.

TABLE 27

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section	Length of Column	l/d	Multi-plying Factor	Safe Bearing Loads in 1000 Pound Units for Values of "C" as indicated: 1000	1100	1200	1300	1400	1500	1600
In.	In.	Sq. In.	Ft.									
6x6	5½x5½	30.25	6	13.1	**1.19**	30.25	33.28	36.30	39.33	42.35	45.38	48.40
		1.19	8	17.5	**1.23**	21.39	23.53	25.67	27.81	29.95	32.09	34.22
			10	21.8	**1.25**	19.21	21.13	23.05	24.97	26.89	28.82	30.74
			12	26.2	**1.27**	17.00	18.70	20.40	22.10	23.80	25.50	27.20
			14	30.5	**1.29**	14.85	16.34	17.82	19.31	20.79	22.28	23.76
8x8	7½x7½	56.25	8	12.8	**1.14**	56.25	61.88	67.50	73.13	78.75	84.38	90.00
		1.14	10	16.0	**1.16**	41.18	45.30	49.42	53.53	57.65	61.77	65.89
			12	19.2	**1.17**	38.19	42.01	45.83	49.65	53.47	57.29	61.10
			14	22.4	**1.18**	35.21	38.73	42.25	45.77	49.29	52.82	56.34
			16	25.6	**1.19**	32.18	35.40	38.62	41.83	45.05	48.27	51.49
			18	28.8	**1.20**	29.19	32.11	35.03	37.95	40.87	43.79	46.70
10x10	9½x9½	90.25	8	10.1	**1.11**	90.25	99.28	108.30	117.33	126.35	135.38	144.40
		1.11	10	12.6	**1.11**	90.25	99.28	108.30	117.33	126.35	135.38	144.40
			12	15.2	**1.13**	67.24	73.96	80.69	87.41	94.14	100.86	107.58
			14	17.7	**1.13**	63.54	69.89	76.25	82.60	88.96	95.31	101.66
			16	20.2	**1.14**	59.75	65.73	71.70	77.68	83.65	89.63	95.60
			18	22.7	**1.14**	56.05	61.66	67.26	72.87	78.47	84.08	89.68
			20	25.3	**1.15**	52.16	57.38	62.59	67.81	73.02	78.24	83.46

12x12	11½x11½	132.25	8 to	8.3	1.09	132.25	145.48	158.70	171.93	185.15	198.38	211.60
		1.09	14	14.6	1.09	132.25	145.48	158.70	171.93	185.15	198.38	211.60
			16	16.7	1.11	95.35	104.89	114.42	123.96	133.49	143.03	152.56
			18	18.8	1.11	90.72	99.79	108.86	117.94	127.01	136.08	145.15
			20	20.9	1.11	86.09	94.70	103.31	111.92	120.53	129.14	137.74
			22	23.0	1.12	81.47	89.62	97.76	105.91	114.06	122.21	130.35
			24	25.0	1.12	76.97	84.67	92.36	100.06	107.76	115.46	123.15
14x14	13½x13½	182.25	8 to	7.1	1.08	182.25	200.48	218.70	236.93	255.15	273.38	291.60
		1.08	16	14.2	1.08	182.25	200.48	218.70	236.93	255.15	273.38	291.60
			18	16.0	1.09	133.41	146.75	160.09	173.43	186.77	200.12	213.46
			20	17.8	1.09	128.12	140.93	153.74	166.56	179.37	192.18	204.99
			22	19.6	1.09	122.65	134.92	147.18	159.45	171.71	183.97	196.24
			24	21.3	1.10	117.37	129.11	140.84	152.58	164.32	176.06	187.79
16x16	15½x15½	240.25	10 to	7.7	1.07	240.25	264.28	288.30	312.33	336.35	360.38	384.40
		1.07	18	14.0	1.07	240.25	264.28	288.30	312.33	336.35	360.38	384.40
			20	15.5	1.08	177.79	195.57	213.35	231.13	248.91	266.69	284.46
			22	17.0	1.08	172.02	189.22	206.42	223.63	240.83	258.03	275.23
			24	18.6	1.08	165.53	182.08	198.64	215.19	231.74	248.30	264.85
18x18	17½x17½	306.25	10 to	6.9	1.06	306.25	336.88	367.50	398.13	428.75	459.38	490.00
		1.06	20	13.7	1.06	306.25	336.88	367.50	398.13	428.75	459.38	490.00
			22	15.1	1.07	229.08	251.99	274.90	297.80	320.71	343.62	366.53
			24	16.5	1.07	221.73	243.90	266.08	288.25	310.42	332.60	354.77
20x20	19½x19½	380.25	10 to	6.2	1.05	380.25	418.28	456.30	494.33	532.35	570.38	608.40
		1.05	24	14.8	1.05	380.25	418.28	456.30	494.33	532.35	570.38	608.40
22x22	21½x21½	462.25	10 to	5.6	1.05	462.25	508.48	554.70	600.93	647.15	693.38	739.60
		1.05	24	13.4	1.05	462.25	508.48	554.70	600.93	647.15	693.38	739.60
24x24	23½x23½	552.25	10 to	5.1	1.04	552.25	607.48	662.70	717.93	773.15	828.38	883.60
		1.04	24	12.3	1.04	552.25	607.48	662.70	717.93	773.15	828.38	883.60
26x26	25½x25½	650.25	10 to	4.7	1.04	650.25	715.28	780.30	845.33	910.35	975.38	1040.40
		1.04	24	11.3	1.04	650.25	715.28	780.30	845.33	910.35	975.38	1040.40

TABLE OF SAFE BEARING LOADS IN 1,000 POUND UNITS FOR SQUARE END DOUGLAS FIR COLUMNS, SYMMETRICALLY LOADED

Based on the formula established by the U. S. Dept. of Agriculture—Forestry Division.*

Working Unit Stress $= C \dfrac{(700+15c)}{(700+15c+c^2)}$ $c = l/d$. l = length of column, in inches. d = least side or diameter, in inches. When l/d is less than 15, use "C."

C = Safe fiber stress in end compression, in pounds per square inch.

Values in this table are based on surfaced sizes. To get values for rough sizes, multiply bearing load by multiplying factor in bold face in same horizontal line. To get cross-section of rough size, multiply area given by factor in bold face directly below.

TABLE 28

Size: Rough	Size: Surfaced S1S1E or S4S	Area Cross Section	Length of Column	l/d	Multi-plying Factor	Safe Bearing Loads in 1000 Pound Units for Values of "C" as indicated: 1000	1100	1200	1300	1400	1500	1600
In.	In.	Sq. In.	Ft.									
6x 6	5½x 5½	30.25 **1.19**	6	13.1	**1.19**	30.25	33.28	36.30	39.33	42.35	45.38	48.40
			8	17.5	**1.23**	22.93	25.22	27.52	29.81	32.10	34.40	36.69
			10	21.8	**1.24**	20.63	22.69	24.76	26.82	28.82	30.95	33.01
			12	26.2	**1.25**	18.57	20.43	22.28	24.14	26.00	27.86	29.71
			14	30.5	**1.26**	16.73	18.40	20.08	21.75	23.42	25.10	26.77
8x 8	7½x 7½	56.25 **1.14**	8	12.8	**1.14**	56.25	61.88	67.50	73.13	78.75	84.38	90.00
			10	16.0	**1.17**	44.16	48.61	53.05	57.50	61.87	66.31	70.60
			12	19.2	**1.17**	40.84	45.07	49.18	53.23	57.43	61.42	65.55
			14	22.4	**1.18**	37.86	41.65	45.43	49.22	53.00	56.79	60.58
			16	25.6	**1.18**	34.99	38.49	41.99	45.49	48.99	52.49	55.98
			18	28.8	**1.19**	32.40	35.64	38.88	42.12	45.36	48.60	51.84
10x10	9½x 9½	90.25 **1.11**	8	10.1	**1.11**	90.25	99.28	108.30	117.33	126.35	135.38	144.40
			10	12.6	**1.11**	90.25	99.28	108.30	117.33	126.35	135.38	144.40
			12	15.2	**1.13**	72.29	79.52	86.75	93.98	101.21	108.44	115.66
			14	17.7	**1.13**	67.96	74.76	81.55	88.35	95.14	101.94	108.74
			16	20.2	**1.14**	63.99	70.39	76.79	83.19	89.59	95.99	102.38
			18	22.7	**1.14**	60.29	66.32	72.35	78.38	84.41	90.44	96.46
			20	25.3	**1.14**	56.59	62.25	67.91	73.57	79.23	84.89	90.54

12x12	11½x11½	132.25 1.09	8 to	8.3	**1.09**	132.25	145.48	158.70	171.93	185.15	198.38	211.60
			14	14.6	**1.09**	132.25	145.48	158.70	171.93	185.15	198.38	211.60
			16	16.7	**1.11**	102.10	112.31	122.52	132.73	142.94	153.15	163.36
			18	18.8	**1.11**	97.07	106.78	116.48	126.19	135.90	145.61	155.31
			20	20.9	**1.11**	92.18	101.40	110.62	119.83	129.05	138.27	147.49
			22	23.0	**1.12**	87.68	96.45	105.22	113.98	122.75	131.52	140.29
			24	25.0	**1.12**	83.45	91.80	100.14	108.49	116.83	125.18	133.52
14x14	13½x13½	182.25 1.08	8 to	7.1	**1.08**	182.25	200.48	218.70	236.93	255.15	273.38	291.60
			16	14.2	**1.08**	182.25	200.48	218.70	236.93	255.15	273.38	291.60
			18	16.0	**1.09**	143.07	157.38	171.68	185.99	200.38	214.61	228.91
			20	17.8	**1.10**	136.87	150.56	164.24	177.93	191.62	205.31	218.99
			22	19.6	**1.10**	131.22	144.34	157.46	170.59	183.71	196.83	209.95
			24	21.3	**1.10**	125.75	138.33	150.90	163.48	176.05	188.63	201.20
16x16	15½x15½	240.25 1.07	10 to	7.7	**1.07**	240.25	264.28	288.30	312.33	336.35	360.38	384.40
			18	14.0	**1.07**	240.25	264.28	288.30	312.33	336.35	360.38	384.40
			20	15.5	**1.08**	191.00	210.10	229.20	248.30	267.40	286.50	305.60
			22	17.0	**1.08**	184.27	202.70	221.12	239.55	257.98	276.41	294.83
			24	18.6	**1.08**	177.06	194.77	212.47	230.18	247.88	265.59	283.30
18x18	17½x17½	306.25 1.06	10 to	6.9	**1.06**	306.25	336.88	367.50	398.13	428.75	459.38	490.00
			20	13.7	**1.06**	306.25	336.88	367.50	398.13	428.75	459.38	490.00
			22	15.1	**1.07**	245.92	270.51	295.10	319.70	344.29	368.88	393.47
			24	16.5	**1.07**	237.34	261.07	284.81	308.54	332.28	356.01	379.74
20x20	19½x19½	380.25 1.05	10 to	6.2	**1.05**	380.25	418.28	456.30	494.33	532.35	570.38	608.40
			24	14.8	**1.05**	380.25	418.28	456.30	494.33	532.35	570.38	608.40
22x22	21½x21½	462.25 1.05	10 to	5.6	**1.05**	462.25	508.48	554.70	600.93	647.15	693.38	739.60
			24	13.4	**1.05**	462.25	508.48	554.70	600.93	647.15	693.38	739.60
24x24	23½x23½	552.25 1.04	10 to	5.1	**1.04**	552.25	607.48	662.70	717.93	773.15	828.38	883.60
			24	12.3	**1.04**	552.25	607.48	662.70	717.93	773.15	828.38	883.60
26x26	25½x25½	650.25 1.04	10 to	4.7	**1.04**	650.25	715.28	780.30	845.33	910.35	975.38	1040.40
			24	11.3	**1.04**	650.25	715.28	780.30	845.33	910.35	975.38	1040.40

*Now U. S. Department of Agriculture, Forest Service.

JOIST CONSTRUCTION

Table 29 shows the lineal feet of joists per square foot of floor space required for joists spaced 12" to 24" on centers. This table also gives the number of board feet of joists and the weight in pounds per square foot of floor space for the various spacings of joists.

JOIST CONSTRUCTION

Lineal feet, board feet and weight per square foot of floor surface for various sizes and spacings of Douglas fir joists.

TABLE 29

Size		Distance on Centers	Per Square Foot of Floor Surface				
Rough	Surfaced S1S1E or S4S		Number of				Weight (Air-dry material at 34 lbs. per cu. ft.)
In.	In.	In.	Lineal Feet		Board Feet		Lbs.
2x 4	1⅝x 3⅝	12	1	1.00	2/3	.67	1.391
2x 4	1⅝x 3⅝	16	3/4	.75	1/2	.50	1.043
2x 4	1⅝x 3⅝	20	3/5	.60	2/5	.40	.8346
2x 6	1⅝x 5⅝	12	1	1.00	1	1.00	2.159
2x 6	1⅝x 5⅝	16	3/4	.75	3/4	.75	1.619
2x 6	1⅝x 5⅝	20	3/5	.60	3/5	.60	1.295
2x 8	1⅝x 7½	12	1	1.00	1-1/3	1.33	2.879
2x 8	1⅝x 7½	16	3/4	.75	1	1.00	2.159
2x 8	1⅝x 7½	20	3/5	.60	4/5	.80	1.727
2x 8	1⅝x 7½	24	1/2	.50	2/3	.67	1.440
2x10	1⅝x 9½	12	1	1.00	1-2/3	1.67	3.644
2x10	1⅝x 9½	16	3/4	.75	1-1/4	1.25	2.733
2x10	1⅝x 9½	18	2/3	.667	1-1/9	1.11	2.441
2x10	1⅝x 9½	20	3/5	.60	1	1.00	2.186
2x10	1⅝x 9½	24	1/2	.50	5/6	.83	1.822
2x12	1⅝x11½	12	1	1.00	2	2.00	4.412
2x12	1⅝x11½	16	3/4	.75	1-1/2	1.50	3.309
2x14	1⅝x13½	12	1	1.00	2-1/3	2.33	5.180
2x14	1⅝x13½	14	6/7	.857	2	2.00	4.439
2x14	1⅝x13½	16	3/4	.75	1-3/4	1.75	3.885
2x16	1⅝x15½	12	1	1.00	2-2/3	2.67	5.947
2x16	1⅝x15½	14	6/7	.857	2-2/7	2.29	5.097
2x16	1⅝x15½	16	3/4	.75	2	2.00	4.460
3x12	2½x11½	12	1	1.00	3	3.00	6.788
3x12	2½x11½	16	3/4	.75	2-1/4	2.25	5.091
3x14	2½x13½	12	1	1.00	3-1/2	3.50	7.967
3x14	2½x13½	14	6/7	.857	3	3.00	6.828
3x14	2½x13½	16	3/4	.75	2-5/8	2.63	5.975
3x16	2½x15½	12	1	1.00	4	4.00	9.144
3x16	2½x15½	14	6/7	.857	3-3/7	3.43	7.836
3x16	2½x15½	16	3/4	.75	3	3.00	6.858
4x16	3½x15½	12	1	1.00	5-1/3	5.33	12.80
4x16	3½x15½	14	6/7	.857	4-4/7	4.57	10.97
4x16	3½x15½	16	3/4	.75	4	4.00	9.600

BOARD MEASURE AND WEIGHT PER LINEAL FOOT FOR VARIOUS SIZES

Table 30 shows the board feet per lineal foot for various sizes based on dimensions of rough timbers. This table also shows the weight per lineal foot for rough and surfaced lumber, both green and air-seasoned.

BOARD MEASURE AND WEIGHT PER LINEAL FOOT FOR DOUGLAS FIR

Green weight based on 32 per cent moisture—38 pounds per cubic foot.

Air-seasoned weight based on 18 per cent moisture—34 pounds per cubic foot.

Oven-dry weight—29 pounds per cubic foot.

TABLE 30

Size		Per Lineal Foot	Weight per Lineal Foot			
			Rough		Surfaced S1S1E or S4S	
Rough	Surfaced S1S1E or S4S		Green	Air Seasoned	Green	Air Seasoned
In.	In.	Board Feet	Lbs.	Lbs.	Lbs.	Lbs.
2x 4	1⅝x 3⅝	⅔	2.111	1.890	1.554	1.391
2x 6	1⅝x 5⅝	1	3.168	2.832	2.411	2.159
2x 8	1⅝x 7½	1⅓	4.220	3.777	3.216	2.879
2x10	1⅝x 9½	1⅔	5.280	4.723	4.073	3.644
2x12	1⅝x11½	2	6.335	5.665	4.931	4.412
2x14	1⅝x13½	2⅓	7.390	6.612	5.788	5.180
2x16	1⅝x15½	2⅔	8.440	7.553	6.648	5.947
2x18	1⅝x17½	3	9.500	8.500	7.505	6.718
2x20	1⅝x19½	3⅓	10.540	9.443	8.360	7.480
3x 6	2½x 5½	1½	4.750	4.250	3.630	3.248
3x 8	2½x 7½	2	6.335	5.665	4.947	4.427
3x10	2½x 9½	2½	7.918	7.085	6.270	5.608
3x12	2½x11½	3	9.500	8.500	7.590	6.788
3x14	2½x13½	3½	11.080	9.915	8.909	7.967
3x16	2½x15½	4	12.660	11.320	10.220	9.144
3x18	2½x17½	4½	14.250	12.750	11.540	10.330
3x20	2½x19½	5	15.820	14.160	12.860	11.510
4x 4	3½x 3½	1⅓	4.220	3.777	3.231	2.890
4x 6	3½x 5½	2	6.335	5.665	5.080	4.545
4x 8	3½x 7½	2⅔	8.440	7.553	6.928	6.200
4x10	3½x 9½	3⅓	10.540	9.450	8.775	7.850
4x12	3½x11½	4	12.660	11.320	10.620	9.507
4x14	3½x13½	4⅔	14.790	13.220	12.460	11.160
4x16	3½x15½	5⅓	16.890	15.110	14.310	12.800
4x18	3½x17½	6	19.000	17.000	16.160	14.460
4x20	3½x19½	6⅔	21.120	18.900	18.010	16.110

(Table 30 Concluded on Next Page.)

TABLE 30—Continued.

Size		Per Lineal Foot	Weight per Lineal Foot			
			Rough		Surfaced S1S1E or S4S	
Rough	Surfaced S1S1E or S4S		Green	Air Seasoned	Green	Air Seasoned
In.	In.	Board Feet	Lbs.	Lbs.	Lbs.	Lbs.
6x 6	5½x 5½	3	9.50	8.50	7.98	7.142
6x 8	5½x 7½	4	12.66	11.32	10.88	9.74
6x10	5½x 9½	5	15.82	14.16	13.79	12.34
6x12	5½x11½	6	19.00	17.00	16.69	14.93
6x14	5½x13½	7	22.16	19.82	19.60	17.54
6x16	5½x15½	8	25.34	22.67	22.50	20.12
6x18	5½x17½	9	28.50	25.50	25.40	22.72
6x20	5½x19½	10	31.67	28.32	28.30	25.32
8x 8	7½x 7½	5⅓	16.89	15.11	14.85	13.28
8x10	7½x 9½	6⅔	21.12	18.90	18.80	16.82
8x12	7½x11½	8	25.34	22 67	22.75	20.36
8x14	7½x13½	9⅓	29 56	26.44	26.72	23.91
8x16	7½x15½	10⅔	33.79	30.22	30.68	27.44
8x18	7½x17½	12	38.00	34.00	34.63	31.00
8x20	7½x19½	13⅓	42.20	37.77	38.58	34.50
10x10	9½x 9½	8⅓	26.40	23.60	23.81	21.31
10x12	9½x11½	10	31.67	28.32	28.83	25.80
10x14	9½x13½	11⅔	36.99	33.02	33.85	30.29
10x16	9½x15½	13⅓	42.20	37.77	38.88	34.79
10x18	9½x17½	15	47.50	42.50	43.89	39 27
10x20	9½x19½	16⅔	52.80	47.22	48.90	43.75
12x12	11½x11½	12	38.00	34.00	34.90	31.21
12x14	11½x13½	14	44.33	39.66	40.97	36.65
12x16	11½x15½	16	50.67	45.33	47.03	42.10
12x18	11½x17½	18	57.00	51.00	53.10	47.50
12x20	11½x19½	20	63.33	56.63	59.19	52 95
14x14	13½x13½	16⅓	51.76	46.30	48.10	43.03
14x16	13½x15½	18⅔	59.13	52.90	55.20	49 40
14x18	13½x17½	21	66.50	59.50	62.33	55.78
14x20	13½x19½	23⅓	73.87	66.10	69.45	62.17
16x16	15½x15½	21⅓	67.57	60.46	63.40	56.71
16x18	15½x17½	24	76.00	68.00	71.58	64.02
16x20	15½x19½	26⅔	84.40	75.50	79.80	71.40
16x22	15½x21½	29⅓	92.90	83.18	87.90	78.67
16x24	15½x23½	32	101.30	90.60	96.10	86 00
18x18	17½x17½	27	85.50	76.50	80.80	72.30
18x20	17½x19½	30	95.00	85.00	90.05	80.60
18x22	17½x21½	33	104.50	93.50	99.26	88.82
18x24	17½x23½	36	114.00	102.00	108.55	97.10
20x20	19½x19½	33⅓	105.50	94.40	100.37	89.75
20x22	19½x21½	36⅔	116.10	103.90	110.60	99.00
20x24	19½x23½	40	126.70	113.40	120.92	108 20
22x22	21½x21½	40⅓	127.80	114.20	122.00	109.15
22x24	21½x23½	44	139.40	124.70	133.40	119.30
24x24	23½x23½	48	152.00	136 00	145.75	130.45
26x26	25½x25½	56⅓	178.40	159 60	171.50	153.50

TABLE OF BOARD MEASURE

Table 31 shows the number of board feet in various sizes, for lengths varying from 10 to 32 feet.

TABLE 31

Size in Inches	Length in Feet											
	10	12	14	16	18	20	22	24	26	28	30	32
2x 4	6⅔	8	9⅓	10⅔	12	13⅓	14⅔	16	17⅓	18⅔	20	21⅓
2x 6	10	12	14	16	18	20	22	24	26	28	30	32
2x 8	13⅓	16	18⅔	21⅓	24	26⅔	29⅓	32	34⅔	37⅓	40	42⅔
2x10	16⅔	20	23⅓	26⅔	30	33⅓	36⅔	40	43⅓	46⅔	50	53⅓
2x12	20	24	28	32	36	40	44	48	52	56	60	64
2x14	23⅓	28	32⅔	37⅓	42	46⅔	51⅓	56	60⅔	65⅓	70	74⅔
2x16	26⅔	32	37⅓	42⅔	48	53⅓	58⅔	64	69⅓	74⅔	80	85⅓
2x18	30	36	42	48	54	60	66	72	78	84	90	96
2x20	33⅓	40	46⅔	53⅓	60	66⅔	73⅓	80	86⅔	93⅓	100	106⅔
3x 6	15	18	21	24	27	30	33	36	39	42	45	48
3x 8	20	24	28	32	36	40	44	48	52	56	60	64
3x10	25	30	35	40	45	50	55	60	65	70	75	80
3x12	30	36	42	48	54	60	66	72	78	84	90	96
3x14	35	42	49	56	63	70	77	84	91	98	105	112
3x16	40	48	56	64	72	80	88	96	104	112	120	128
3x18	45	54	63	72	81	90	99	108	117	126	135	144
3x20	50	60	70	80	90	100	110	120	130	140	150	160
4x 4	13⅓	16	18⅔	21⅓	24	26⅔	29⅓	32	34⅔	37⅓	40	42⅔
4x 6	20	24	28	32	36	40	44	48	52	56	60	64
4x 8	26⅔	32	37⅓	42⅔	48	53⅓	58⅔	64	69⅓	74⅔	80	85⅓
4x10	33⅓	40	46⅔	53⅓	60	66⅔	73⅓	80	86⅔	93⅓	100	106⅔
4x12	40	48	56	64	72	80	88	96	104	112	120	128
4x14	46⅔	56	65⅓	74⅔	84	93⅓	102⅔	112	121⅓	130⅔	140	149⅓
4x16	53⅓	64	74⅔	85⅓	96	106⅔	117⅓	128	138⅔	149⅓	160	170⅔
4x18	60	72	84	96	108	120	132	144	156	168	180	192
4x20	66⅔	80	93⅓	106⅔	120	133⅓	146⅔	160	173⅓	186⅔	200	213⅓

(Table 31 Continued on Next Page.)

TABLE 31—Continued.

Size in Inches	Length in Feet											
	10	12	14	16	18	20	22	24	26	28	30	32
6x 6	30	36	42	48	54	60	66	72	78	84	90	96
6x 8	40	48	56	64	72	80	88	96	104	112	120	128
6x10	50	60	70	80	90	100	110	120	130	140	150	160
6x12	60	72	84	96	108	120	132	144	156	168	180	192
6x14	70	84	98	112	126	140	154	168	182	196	210	224
6x16	80	96	112	128	144	160	176	192	208	224	240	256
6x18	90	108	126	144	162	180	198	216	234	252	270	288
6x20	100	120	140	160	180	200	220	240	260	280	300	320
8x 8	53⅓	64	74⅔	85⅓	96	106⅔	117⅓	128	138⅔	149⅓	160	170⅔
8x10	66⅔	80	93⅓	106⅔	120	133⅓	146⅔	160	173⅓	186⅔	200	213⅓
8x12	80	96	112	128	144	160	176	192	208	224	240	256
8x14	93⅓	112	130⅔	149⅓	168	186⅔	205⅓	224	242⅔	261⅓	280	298⅔
8x16	106⅔	128	149⅓	170⅔	192	213⅓	234⅔	256	277⅓	298⅔	320	341⅓
8x18	120	144	168	192	216	240	264	288	312	336	360	384
8x20	133⅓	160	186⅔	213⅓	240	266⅔	293⅓	320	346⅔	373⅓	400	426⅔
10x10	83⅓	100	116⅔	133⅓	150	166⅔	183⅓	200	216⅔	233⅓	250	266⅔
10x12	100	120	140	160	180	200	220	240	260	280	300	320
10x14	116⅔	140	163⅓	186⅔	210	233⅓	256⅔	280	303⅓	326⅔	350	373⅓
10x16	133⅓	160	186⅔	213⅓	240	266⅔	293⅓	320	346⅔	373⅓	400	426⅔
10x18	150	180	210	240	270	300	330	360	390	420	450	480
10x20	166⅔	200	233⅓	266⅔	300	333⅓	366⅔	400	433⅓	466⅔	500	533⅓
12x12	120	144	168	192	216	240	264	288	312	336	360	384
12x14	140	168	196	224	252	280	308	336	364	392	420	448
12x16	160	192	224	256	288	320	352	384	416	448	480	512
12x18	180	216	252	288	324	360	396	432	468	504	540	576
12x20	200	240	280	320	360	400	440	480	520	560	600	640

TABLE 31—Continued.

Size in Inches	Length in Feet											
	10	12	14	16	18	20	22	24	26	28	30	32
14x14	163⅓	196	228⅔	261⅓	294	326⅔	359⅓	392	424⅔	457⅓	490	522⅔
14x16	186⅔	224	261⅓	298⅔	336	373⅓	410⅔	448	485⅓	522⅔	560	597⅓
14x18	210	252	294	336	378	420	462	504	546	588	630	672
14x20	233⅓	280	326⅔	373⅓	420	466⅔	513⅓	560	606⅔	653⅓	700	746⅔
16x16	213⅓	256	298⅔	341⅓	384	426⅔	469⅓	512	554⅔	597⅓	640	682⅔
16x18	240	288	336	384	432	480	528	576	624	672	720	768
16x20	266⅔	320	373⅓	426⅔	480	533⅓	586⅔	640	693⅓	746⅔	800	853⅓
16x22	293⅓	352	410⅔	469⅓	528	586⅔	645⅓	704	762⅔	821⅓	880	938⅔
16x24	320	384	448	512	576	640	704	768	832	896	960	1024
18x18	270	324	378	432	486	540	594	648	702	756	810	864
18x20	300	360	420	480	540	600	660	720	780	840	900	960
18x22	330	396	462	528	594	660	726	792	858	924	990	1056
18x24	360	432	504	576	648	720	792	864	936	1008	1080	1152
20x20	333⅓	400	466⅔	533⅓	600	666⅔	733⅓	800	866⅔	933⅓	1000	1066⅔
20x22	366⅔	440	513⅓	586⅔	660	733⅓	806⅔	880	953⅓	1026⅔	1100	1173⅓
20x24	400	480	560	640	720	800	880	960	1040	1120	1200	1280
22x22	403⅓	484	564⅔	645⅓	726	806⅔	887⅓	968	1048⅔	1129⅓	1210	1290⅔
22x24	440	528	616	704	792	880	968	1056	1144	1232	1320	1408
24x24	480	576	672	768	864	960	1056	1152	1248	1344	1440	1536
26x26	563⅓	676	788⅔	901⅓	1014	1126⅔	1239⅓	1352	1464⅔	1577⅓	1690	1802⅔

MILL BUILDINGS

In recent years marked improvements have been made in the construction of mill buildings. These improvements have been of such a nature as to reduce maintenance cost, fire risk, and insurance rates, and to insure a longer life for the structure. This discussion will be confined largely to that type of building known as the timber-brick mill building.

There are a number of significant details which should be considered in the design of every modern mill building. The addition of these details is inexpensive, and the accruing benefits far outweigh the added cost. Some of the most significant features which should receive consideration in the design of the highest class of mill building, are as follows:

1. All exterior windows should be fitted with wired glass in metal frames;
2. As many subdivisions in the building as are practicable should be provided, both horizontally and vertically.
3. Protect timber details where necessary with a brush application of coal-tar creosote, or other suitable preservative;
4. Install an automatic sprinkler system as a fire protection;
5. Use only large timber joists, girders and posts;
6. Use wide spacing of joists, and thick tongued and grooved or laminated floors;
7. Laminated floor timbers should be thoroughly kiln dried before being placed in the building to prevent dry rot;
8. Provide stairway and elevator enclosures.

The cost, durability, and insurance rates on a building and contents are factors which concern the builder who must finance the building. He will naturally endeavor to get a building low in first cost, and also low in insurance and maintenance cost. In other words, he will or should strive to get the greatest possible returns for each dollar spent. The following discussion bears on the above factors, and presents information which is of vital interest to the builder.

DURABILITY

The durability of a mill building may be greatly increased by a few simple operations. The decay of wood, which is hastened by the presence of damp air and poor ventilation, starts most readily on the end grain of timbers such as girders and columns.

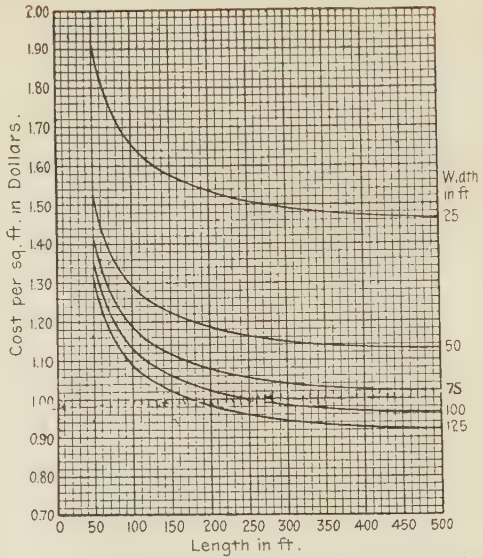


Fig. 1. Size-Cost Diagram for Brick Mill Buildings; One-Story.

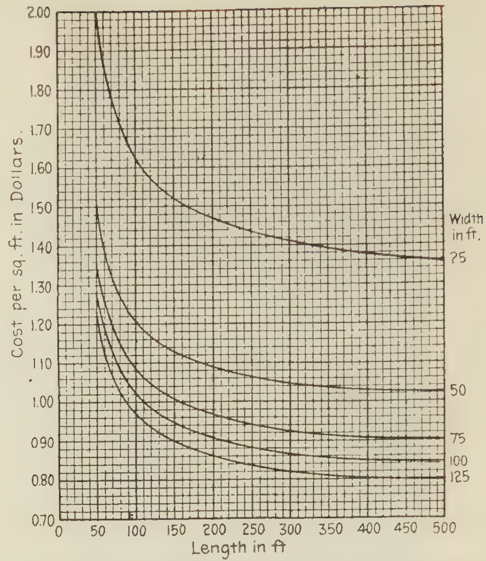


Fig. 2. Size-Cost Diagram for Brick Mill Buildings; Two-Story.

Diagram 16. Size-cost diagrams for 1 and 2 story timber-brick mill structures. Floor loading 75 pounds per sq. ft..

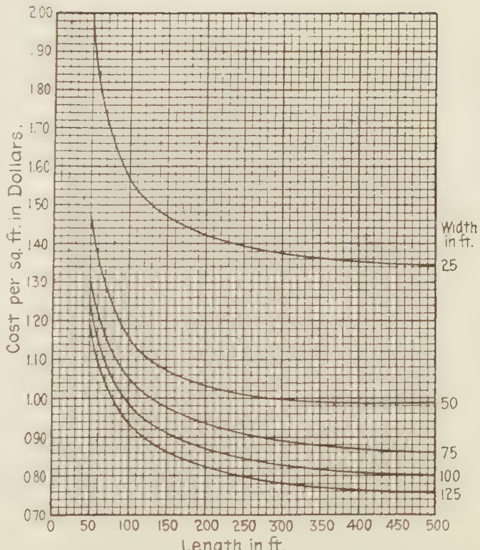


Fig. 3. Size-Cost Diagram for Brick Mill Buildings; Three-Story.

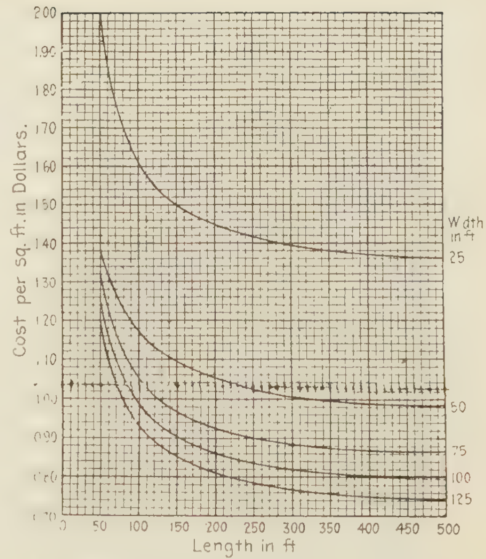


Fig. 4. Size-Cost Diagram for Brick Mill Buildings; Four-Story.

Diagram 17. Size-cost diagrams for 3 and 4 story timber-brick mill structures. Floor loading 75 pounds per sq. ft..

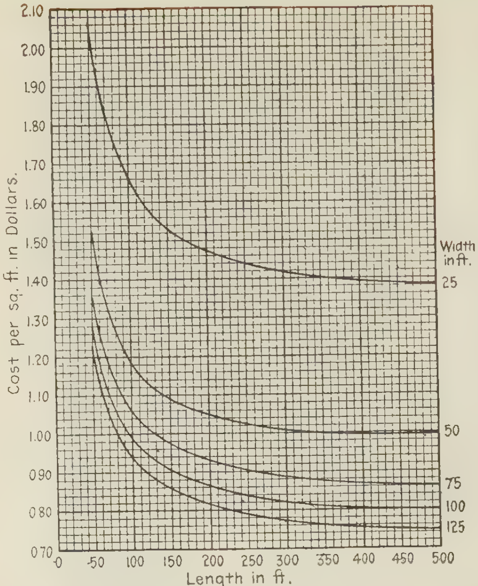


Fig. 5. Size-Cost Diagram for Brick Mill Buildings, Five-Story.

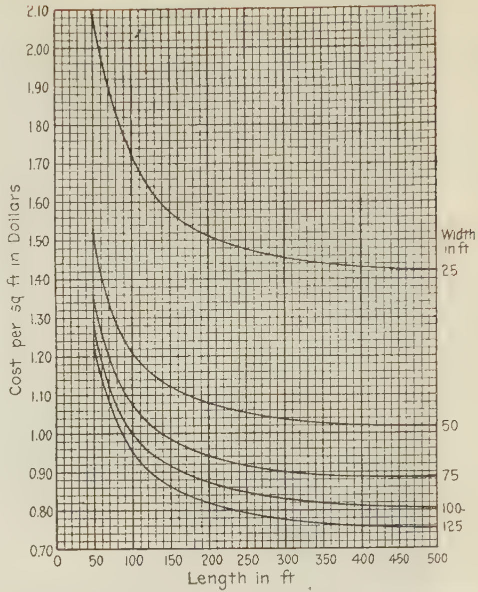


Fig. 6. Size-Cost Diagram for Brick Mill Buildings; Six-Story.

Diagram 18. Size-cost diagrams for 5 and 6 story timber-brick mill structures. Floor loading 75 pounds per sq. ft.

Fig. 8. Some details of heavy timber construction in a mill building recently constructed in Seattle. Note application of creosote at base of column in foreground.

This fact should be recognized and methods of construction so modified as to prevent conditions favorable to decay. Dry lumber should be used wherever possible and in the construction of laminated floors all lumber should be thoroughly kiln dried before being placed in the structure.

Girders or joists which rest in masonry walls should not be sealed in. An air space of at least two inches should be provided all around the end to allow proper ventilation. Two brush applications of hot coal-tar creosote or other suitable preservative will assist materially in preventing decay. Ends of girders or joists should rest on cast iron plates or joist hangers, and the bearing surface should be protected by a piece of creosote-saturated felt or asbestos.

Columns, when resting on concrete or brick piers, should have ends thoroughly painted with two coats of hot coal-tar creosote, and a piece of thin creosote-saturated board should be placed between column and pier. A metal plate between the pier and column end is also desirable. Creosote applied to the ends of columns between floors will also assist in preventing dry rot.

The above details are particularly necessary in buildings which are unheated, and are desirable in all buildings. The ends of large girders and joists should never be encased in such a way as to prevent seasoning through the end surface. Seasoning takes place more rapidly through the end grain than from any other surface, and seasoned timber is safe from dry rot just as long as it is kept dry.

The limited use of coal-tar creosote as above described should not increase fire hazard. There are, of course, other preservatives such as zinc chloride and corrosive sublimate which could not possibly increase fire dangers. These preservatives are likely to be less effective, however, than coal-tar creosote, and corrosive sublimate is a deadly poison. Fig. 8 shows some details of the heavy timbering in a mill building recently constructed in Seattle. Note the application of creosote to prevent decay at base of column in the foreground.

COST

The cost of mill buildings has been well established, and diagrams 16 to 18 will permit a quick estimate on varying sizes and heights of timber-brick mill buildings with floor loads up to 75 pounds per square foot.

These data have been taken from an article by Charles T. Main, M. Am. Soc. M. E., published in Engineering News, January 27, 1910. The diagrams are based upon the following unit values given by Mr. Main for the various materials used:

"The cost of brick walls is based on 22 bricks per cubic foot, costing $18 per thousand, laid. Openings are estimated at 40 cents per sq. ft., including windows, doors and sills.

"Ordinary mill floors, including timbers, planking and top floor with Southern pine timber at $40 per M ft. B. M. and spruce planking at $30 per M., costs about 32 cents per sq. ft., which has been used as a unit price. Ordinary mill roofs covered with tar and gravel, with lumber at the above prices, cost about 25 cents per sq. ft. and this has been used in the estimates. Add for stairways, elevator wells, plumbing, partitions and special work."

The diagrams are to be used when all conditions are normal. There are many different conditions encountered in practice which influence the cost of buildings. The following special cases are mentioned in Mr. Main's discussion, which cover various conditions and classes of buildings.

"(a) If the soil is poor or the conditions of the site are such as to require more than the ordinary amount of foundations, the cost will be increased.

"(b) If the end or a side of the building is formed by another building, the cost of one or the other will be reduced slightly.

"(c) If the building is to be used for ordinary storage purposes with low stories and no top floors, the cost will be decreased from about 10% for large low buildings, to 25% for small high ones, about 20% usually being a fair allowance.

"(d) If the buildings are to be used for manufacturing purposes and are to be substantially built of wood, the cost will be decreased from about 6% for large one-story buildings, to 35% for small high buildings; 15% would usually be a fair allowance.

"(e) If the buildings are to be used for storage with low stories and built substantially of wood, the cost will be decreased from 13% for large one-story buildings, to 50% for small high buildings; 30% would usually be a fair allowance.

"(f) If the total floor loads are more than 75 lbs. per sq. ft. the cost is increased.

"(g) For office buildings, the cost must be increased to cover architectural features on the outside and interior finish."

Mr. Main makes the following significant deductions from the diagrams:

"(1) An examination of the diagrams shows immediately the decrease in cost as the width is increased. This is due to the fact that the cost of the walls and outside foundations, which is an important item of cost, relative to the total cost, is decreased as the width increases.

"For example, supposing a three-story building is desired with 30,000 sq. ft. on each floor:

"If the building were 600 ft. x 50 ft., its cost would be about 99 cents per sq. ft..

"If the building were 400 ft. by 75 ft., its cost would be about 87 cents per sq. ft..

"If the building were 300 ft. x 100 ft., its cost would be about 83 cents per sq. ft..

"If the building were 240 ft. x 125 ft., its cost would be about 80 cents per sq. ft..

"(2) The diagrams show that the minimum cost per square foot is reached with a four-story building. A three-story building costs a trifle more than a four-story. A one story building is the most expensive. This is due to the combination of several features: (a) The cost of ordinary foundations does not increase in proportion to the number of stories, and therefore their cost is less per square foot as the number of stories is increased, at least up to the limit of the diagram. (b) The roof is the same for a one-story building as for one of any other number of stories, and therefore its cost relative to the total cost grows less as the number of stories increases. (c) The cost of columns, including the supporting piers and castings, does not vary much per story as the stories are added. (d) As the number of stories increases, the cost of the walls, owing to increased thickness, increases in a greater ratio than the number of stories, and this item is the one which in the four story-building offsets the saving in foundations and roof.

Tables 32 and 33 show the unit values used in computing the diagrams:

DATA FOR ESTIMATING COST OF BUILDINGS

TABLE 32

Height	Foundations Including Excavations Cost per Lin. Ft.		Brick Walls Cost per Sq. Ft. of Surface		Columns including Piers and Castings
	For Outside Walls	For Inside Walls	Outside Walls	Inside Walls	Cost of One
One-Story Building.......	$2.00	$1.75	$0.40	$0.40	$15.00
Two-Story Building.......	2.90	2.25	.44	.40	15.00
Three-Story Building.....	3.80	2.80	.47	.40	15.00
Four-Story Building......	4.70	3.40	.50	.43	15.00
Five-Story Building.......	5.60	3.90	.53	.45	15.00
Six-Story Building........	6.50	4.50	.57	.47	15.00

DATA FOR APPROXIMATING COST OF MILL BUILDINGS OF KNOWN SIZE BUT WITHOUT DEFINITE PLANS MADE

TABLE 33

Height of Building	Foundations Including Excavation Cost per Lin. Ft.		Brick Walls Including Doors and Windows. Cost per Sq. Ft. of Surface	
	For Outside Walls	For Inside Walls	Outside Walls	Inside Walls
One Story..........................	$2.00	$1.75	$0.40	$0.40
Two Stories........................	2.90	2.25	.44	.40
Three Stories......................	3.80	2.80	.47	.40
Four Stories.......................	4.70	3.40	.50	.43
Five Stories.......................	5.60	3.90	.53	.45
Six Stories........................	6.50	4.50	.57	.47

Mr. Main gives the following general information which is useful in making estimates:

"From ground to first floor, 3 ft.. Buildings 25 ft. wide, stories 13 ft. high. Buildings 50 ft. wide, stories 14 ft. high. Buildings 75 ft. wide, stories 15 ft. high. Buildings 100 ft. wide, stories 16 ft. high. Buildings 125 ft. wide, stories 16 ft. high.

"Floors, 32 cents per sq. ft. of gross floor space not including columns. If columns are included, 38 cents.

"Roof, 25 cents per sq. ft., not including columns. If columns are included, 30 cents. Roof to project 18 inches all around buildings.

"Stairways, including partitions, $100 each flight. Allow two stairways, and one elevator tower for buildings up to 150 ft. long. Allow two stairways and two elevator towers for buildings up to 300 ft. long. In buildings over two stories, allow three stairways and three elevator towers for buildings over 300 ft. long.

"In buildings over two stories, plumbing $75 for each fixture, including piping and partitions. Allow two fixtures on each floor up to 5,000 sq. ft. of floor space and add one fixture for each additional 5,000 sq. ft. of floor or fraction thereof."

INSURANCE RATES

Mill buildings of modern design are subject to low insurance rates. This fact is oftentimes lost sight of, due to confusing the good types of mill construction with poor ones. Of course, the insurance rate on poorly designed mill buildings is considerably higher than that on the fire-resisting type of construction. The following quotation is taken from an address by Chester J. Hogue, M. Am. Soc. C. E., given at a Lumbermen's Dinner in Portland, Oregon, October 15, 1915:

"Now the best comparison of safe types of fire-resisting construction can perhaps be shown by comparative insurance rates—by the judgment of men whose business it is to study this question. We have in Portland secured comparative insurance rates on a specific case, assuming a furniture store occupancy, and the rate on the wood construction building was 47 cents and on the fire proof building 35 cents, and with sprinklers, the comparison was 28 cents on the mill construction as against 21 cents on the fire proof, these rates being on the building, not the contents. The rate for the mill construction building, sprinklered, 28 cents, was less than the 35 cents on the unprinklered fire proof building.

"I also had rates from the Chicago Board of Fire Underwriters, assuming a machine shop occupancy. The rate on a building not sprinklered, of mill construction, was $1.11 as against 24 cents for fire proof construction; and sprinklered, 15 cents for mill construction as against 14 cents for fire proof material. The

comparison there between the sprinklered mill construction building, shows 15 cents as against 24 cents for the non-sprinklered fire proof building, and where both are sprinklered, only 1 cent difference. On the contents, the rate on non-sprinklered mill construction was $1.36 as against 64 cents for the fire proof construction; the rates on the contents sprinklered were 30 cents for the mill construction as against 26 cents for the fire proof building. The comparison there between the sprinklered mill construction was 30 cents as against 64 cents for non-sprinklered fire proof construction.

"This shows clearly that a sprinklered mill construction building is a safer risk from a fire insurance standpoint than one of non-sprinklered fire proof construction. The sprinklered mill construction building is safer both as to building and contents than a fire proof building non-sprinklered. In the same way, a mill construction building with properly constructed stairways, and elevator shafts, is safer as to contents than a non-sprinklered fire proof structure with unprotected stairways and elevator shafts.

"I believe, from my experience in both kinds of construction, that the mill construction building, with masonry walls, wire glass windows and sprinklered, would have almost as great an effect in stopping a conflagration as if the interior was of so-called fire proof construction—that is, of incombustible materials."

The modern timber-brick mill building is approximately 25% lower in first cost than a fire-resisting building, and is given almost the same advantage in insurance rates. Throughout the Pacific Coast territory where timber is inexpensive and plentiful, the difference in cost between these types of buildings will probably average above 25%.

Wood construction is safe when the proper design has been used. Its low first cost and maintenance, and its low insurance rates are strong arguments in its favor which should be carefully weighed by architects and engineers when contemplating the design of new buildings.

PILING

Douglas fir has long been considered an ideal piling material. It possesses high strength values and may be obtained in lengths varying from 10 feet to 120 feet. Due to the fact that this species grows in thick stands, it is possible to secure straight sticks almost entirely free from knots and other defects. In order to obtain reliable figures on the dimensions of Douglas fir piling, a large number of measurements have been taken on piles from two of the principal producing districts of Oregon and Washington. Approximately 50 piles of each length were taken, the lengths varying from 50 to 111 feet. Piling from the Columbia River district in Oregon, and the Puget Sound district in Washington were used in obtaining these data. Diagrams 19 and 20 show the size and natural taper of the timber. For example, if it is desired to buy piling 80 feet long and of any given butt diameter, the probable corresponding top diameter is shown on these diagrams. Of course, there is considerable variation in the individual sticks. These diagrams, however, show what actually grows and should be useful in placing practicable dimensions on Douglas fir piling when writing specifications.

The following specification for Douglas fir piling is suggested as a guide for those writing specifications for this material.

SPECIFICATION FOR DOUGLAS FIR PILING

The following specification covers two general classes of piling.

For Creosoting. Piling shall be cut from sound, live Douglas fir trees, free from felling or wind shakes, loose or unsound knots, large knots or small knots in great numbers, or other defects which in any way impair the strength or durability for the purpose intended. Each pile should have at least one-half inch of sapwood.

Piling shall be butt cut and free from swelling. Diameter three feet from butt shall not be smaller than the butt diameter by an amount greater than one inch. They shall be free from short or reverse bends. Piling shall be so straight that a line drawn from the center of the two ends shall at no point fall outside the pile. Some variations in this respect will be allowed in sticks 80 feet or more in length.

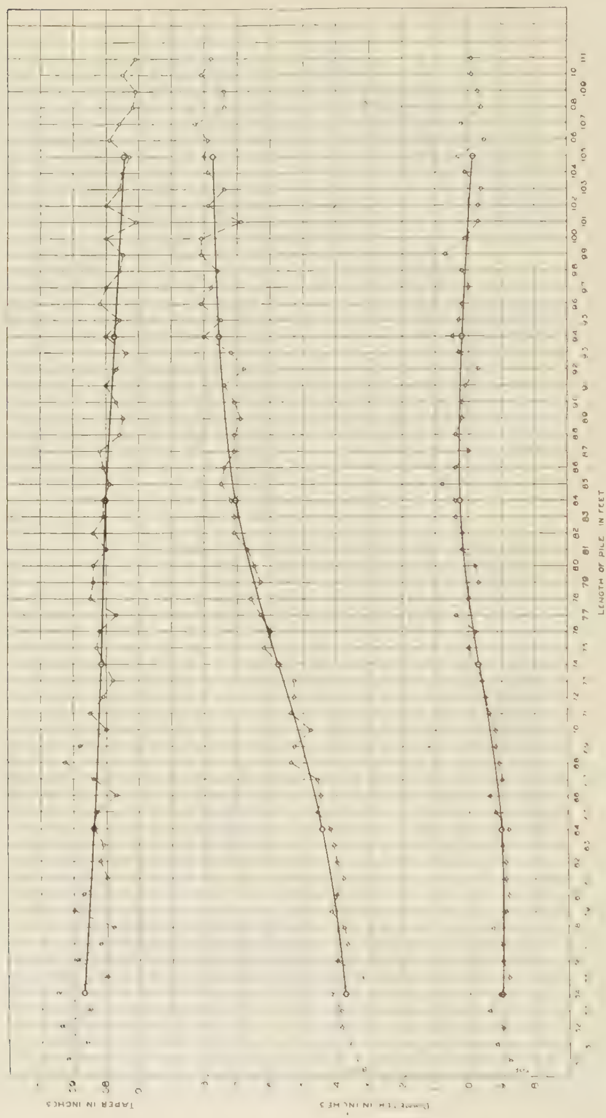


Diagram 19. Average butt and top diameters and the taper per lineal foot for Douglas fir piles from the Columbia River district.

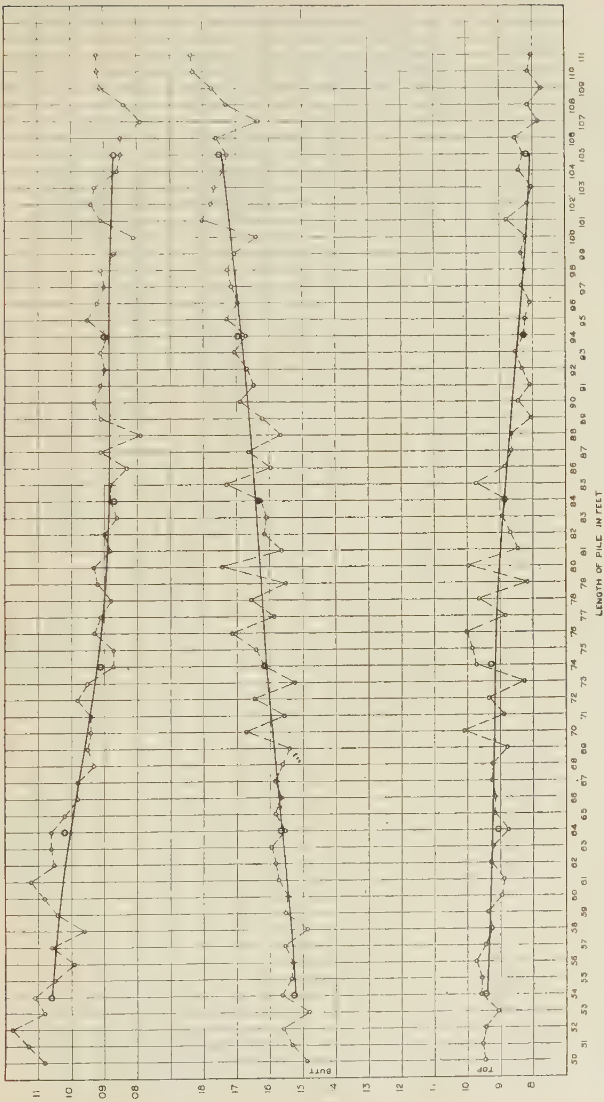


Diagram 20. Average butt and top diameters and the taper per lineal foot for Douglas fir piles from the Puget Sound district.

Piling shall be free from damage by sea worms or other insects and shall be carefully peeled free from bark, and all knots shall be smoothly dressed.

FOR TEMPORARY USE. Piling shall be of Douglas fir or other species which will stand driving, free from loose or unsound knots, felling shakes, heart or wind shakes, sea worm holes, or other defects which impair its use for the purpose intended. Knots shall be trimmed close and no short or reverse bends allowed. No crooks shall be permitted exceeding one-half the diameter of pile at the middle of the bend.

CREOSOTED PILE DOCKS

During the past few years creosoted Douglas fir piling has been extensively used throughout this country for marine work. Properly creosoted Douglas fir piling withstands the attack of the marine borer for many years, and has come into very general use. Experience on the Pacific Coast has shown that a creosoted pile dock will last, on a very conservative estimate, for 18 to 20 years. In the same teredo-infested waters the life of an untreated pile dock would not exceed three to six years.

Creosoted Douglas fir piling has been found to be the most economical material for dock construction on the Pacific Coast. Large docks supporting superstructures when built on creosoted piling will cost approximately $1.25 per square foot, while similar structures built on reinforced concrete will cost on the average approximately $3.00 per square foot.

On the assumption that a creosoted pile dock costs $1.25 per square foot and requires 30 per cent of the original cost to keep it in repair through a period of 25 years and that a reinforced concrete pile dock costs $3.00 per square foot and lasts through a period of 50 years, the concrete dock will cost approximately 35 per cent more at the end of a 50-year period than the creosoted pile dock.

At the present time the commercial life of a dock of any type of construction will not exceed 30 years, due to the fact that methods of handling freight and shipping facilities are constantly changing. A dock which amply fulfills requirements today may be entirely inadequate 30 years from now. Due to this fact a

creosoted pile dock has the advantage of being entirely remodeled at the end of 25 to 30 years to meet the changed conditions of shipping. This is a practical point greatly in favor of a creosoted pile dock as against one of reinforced concrete, since the latter type would have to last much longer than 30 years to warrant the high initial cost of $3.00 per square foot.

Due to the greater economy found in creosoted pile dock construction, the State Harbor Commission adopted this type of construction every place where it was practicable to drive wooden piling, in developing an elaborate system of docks in San Francisco Harbor. The "Port of Seattle Commission" also adopted creosoted pile dock construction in its extensive water front development projects for Seattle. Figures 9 to 11 show two of Seattle's dock projects during course of construction and one after completion.

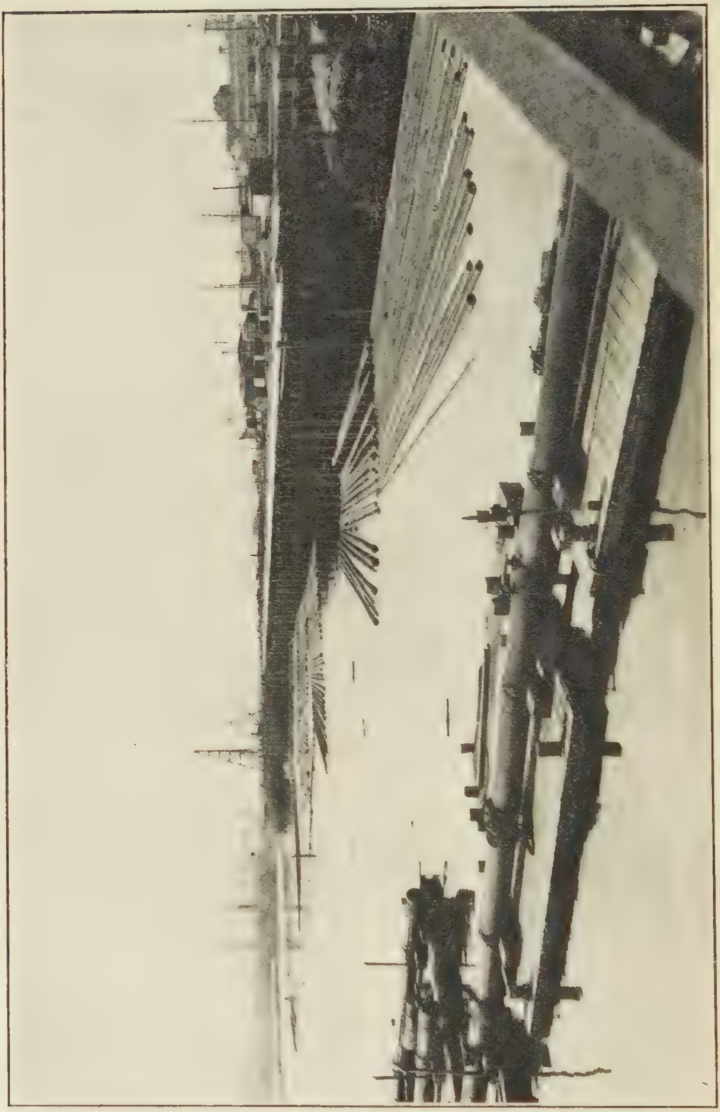


Fig 9. Hanford Street Wharf, Port of Seattle. Driving 250,000 lineal feet of creosoted Douglas fir piling in salt water.

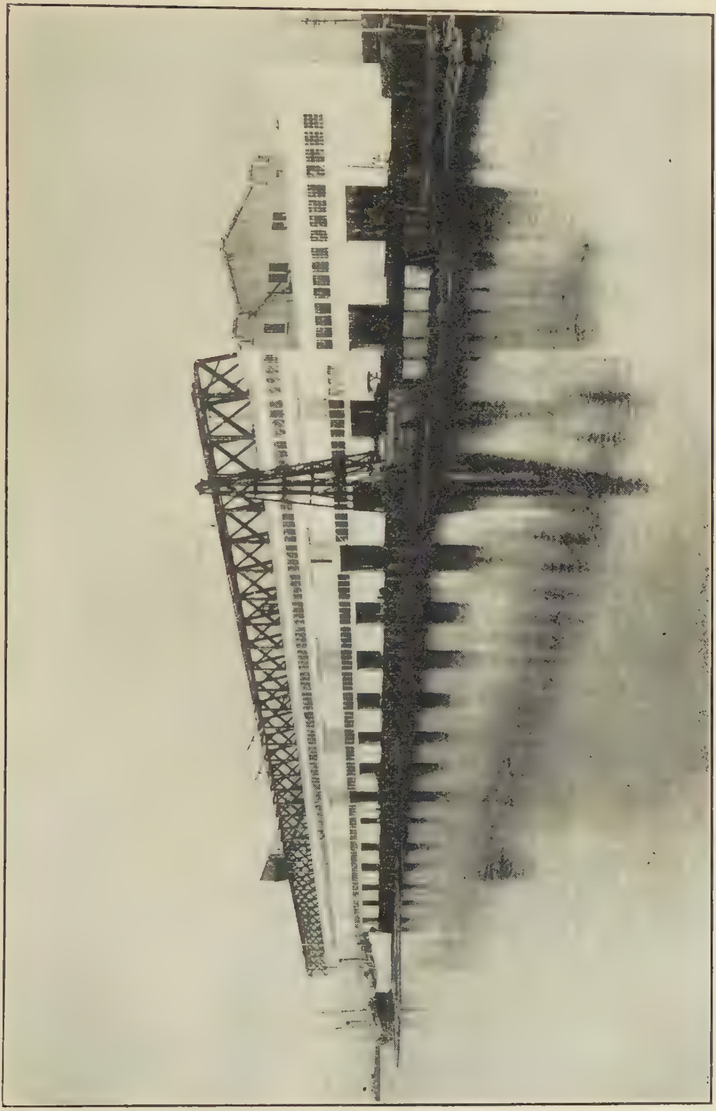


Fig. 10. Hanford Street Wharf, Port of Seattle, after completion. Example of slow-burning dock construction.

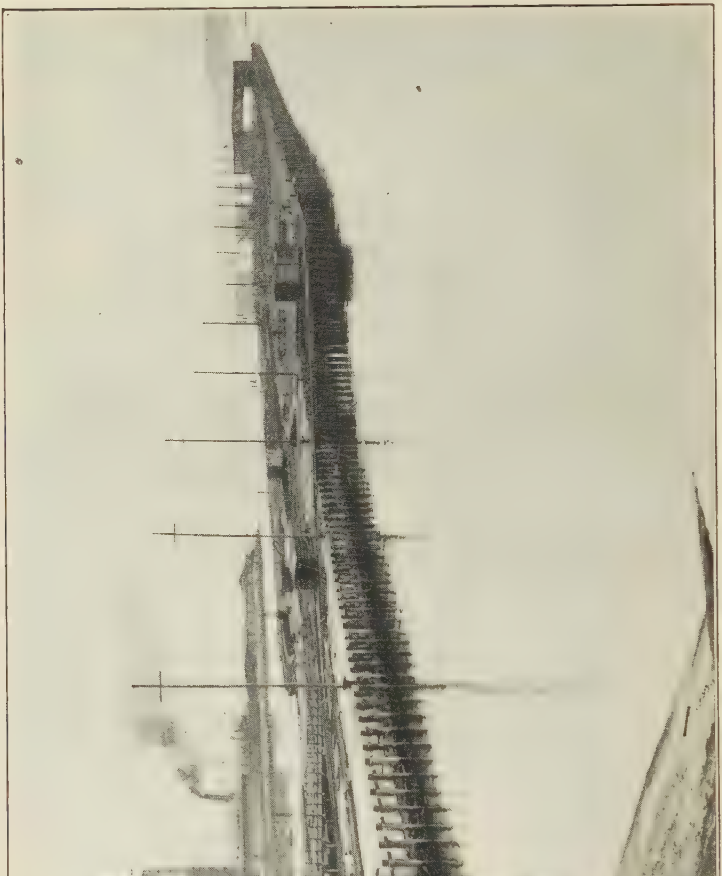


Fig. 11. Smith Cove Dock, Port of Seattle, one of the largest piers in the United States. Great Northern Dock on left where S. S. Minnesota docks. Both docks built on creosoted Douglas fir piling.

WOOD STAVE PIPES AND FLUMES

There is a large field for the use of creosote in connection with pipe and flume staves, used in irrigation and power development projects. Wood stave pipe has taken a prominent place in the development of irrigation districts in the West. Wood stave pipe and flumes are low in first cost and the co-efficient of friction is very small. Due to this latter fact a larger amount of water can usually be delivered through a wood pipe of a given size, all other conditions being the same, than through pipes of any other material. Wood pipe in general has the following advantages to recommend it:

1. It will stand high pressure.
2. It is light and may be readily and cheaply transported.
3. It has a very low co-efficient of friction.
4. It is simple and easy to install.
5. Connections may be quickly made at any point.
6. Wood pipe will not freeze and burst in winter.
7. It is not injured by slight settlements which may occur.

CAUSES OF DECAY IN WOOD PIPE

If the fibers of the wood are thoroughly saturated with water, decay is impossible. Neither can the fungus thrive if the wood is thoroughly dry. There is, however, an intermediate condition of moisture, which assists the growth of wood-destroying fungi.

Most irrigation systems are in operation but a part of each year and are therefore empty a considerable portion of the time. This condition will result in a short life for untreated wood pipe as this lack of fiber saturation is the cause of almost all decay in wood pipe. Where the pipe is under sufficient hydrostatic pressure to assure thorough saturation of the fiber, and where the pipe line is exposed to the air, untreated pipe will give good service. But, where the pressure of the water is less than a 20-foot head, or where the pipe line is only filled a portion of the time, or again, where the pipe is buried in porous, sandy, gravelly or loam soils, untreated pipe is subject to decay.

The following conditions are discussed as most favorable for decay in the various styles of wood stave pipe:

Continuous Stave. Continuous stave pipe which is exposed is most subject to decay at the joints. The following quotation

is taken from U. S. Department of Agriculture Bulletin No. 155 (Professional Paper).

"Decay of exposed pipes almost invariably starts at the ends of staves, as a result of leaky joints. Where water leaks out and runs down over the outside of the pipe favorable conditions are afforded for the growth of algae, which usually get a start, then mosses may begin to grow in the soil that collects on such spots, and decay spreads to adjoining staves."

Wood is more liable to attack by fungus on the end grain than on any other surface, which accounts for the development of decay at the end joints.

Wire-Wound Banded Couplings. The greatest point of weakness in this type of pipe is the banded joints. It is impossible to keep the bands saturated and hence decay sets in quickly, and spreads to other portions of the pipe.

Wire-Wound Inserted Couplings. This type of wood pipe also fails at the joints, resulting from a lack of water saturation due to physical conditions. The joints are most liable to attack by fungus when the pipe line deviates from a straight line, either in a vertical or horizontal direction. It is at these joints that decay almost always starts.

The three above mentioned types of wood stave pipe when used in an untreated condition, are also subject to decay under the following conditions:

(1) When pipe line is under less than twenty-foot head hydrostatic pressure, or when pipe is empty a portion of the time.
(2) When pipe line is buried in loam, sandy or gravelly soil.
(3) When vegetable matter comes in contact with the staves.

The following quotations are taken from U. S. Department of Agriculture Bulletin No. 155:

"Based upon the experience in Spokane, Wash., the life of machine-banded wood pipe is given as ranging from 4 to 12 years. Such short life in most instances is probably due to bad judgment in the matter of location or the use of pipe under conditions altogether unfavorable to its life."

"In contact with soil the durability is nearly always a matter of some uncertainty."

"Contrary to the theories commonly held 30 years ago, it has been found that the durability of wood pipe is usually dependent on the life of the wood pipe rather than on the life of the bands.

Only in rare instances, some of which have been cited, have the bands failed first."

"Where pipes are to be placed in contact with the soil, and where the internal pressure is not sufficient to insure complete saturation of the staves, it is probable that their durability may be increased by treating with some preservative."

ELIMINATING DECAY IN WOOD PIPE

There is no question but that a well creosoted wood stave pipe will prove a good investment under conditions unfavorable to untreated pipe. The treatment is not expensive since the pipe is composed of merely a wooden shell and does not require much oil per lineal foot of pipe.

Creosoted Wood Pipe. The best creosote treatment for pipe is about as follows:

Pipe staves should be kiln dried and machined before treatment. Boil in oil or steam staves until in proper condition to receive the coal-tar creosote. Then press 10 to 11 pounds of oil per cubic foot into the wood at a temperature of 180 degrees Fahrenheit. Then release pressure and heat the charge in oil to a temperature of 230 to 240 degress F., and hold at this temperature for one hour. This final heating bath expands the oil and removes the excess, thus preventing its mixing with the water later on when in service.

The pipe for use on the individual ranch, may after treatment, be buried in any kind of soil and subjected to severe adverse conditions without damage by decay. *It so happens that the very point in the pipe which is most subject to decay, namely, the end grain at joints and couplings, becomes more thoroughly impregnated with preservative than any other portion of the stave.* This physical condition aids greatly in securing the greatest durability from the creosote treatment.

Wood stave pipe used under unfavorable conditions, where decay would occur in five or six years, should, if properly creosoted, last 20 to 25 years and probably longer. *The cost of the aforementioned treatment is small, amounting to but 15 to 30 per cent of the cost of untreated pipe installed* and should result in an increased length of life of two to six times that of the untreated pipe, depending upon prevailing conditions of soil, moisture, exposure, etc.. Creosoted pipe cannot be too strongly recommended, for its use eliminates the uncertainties found in untreated wood pipe.

FLUMES

There is an exceptionally good opportunity for the use of creosoted wood staves in flume building. The conditions for decay in wood pipe previously mentioned apply to open flumes and since it is not possible to depend on water saturation of the wood in open flumes, creosote treatment is highly recommended.

DOUGLAS FIR SILOS

Wooden silos are the least expensive type of silo and are in more general use throughout the country than any other form. As a result of a systematic study of the good and bad points of the wooden silo, rapid progress has been made during the last few years in perfecting this type.

MATERIALS OF CONSTRUCTION AND COST

A great variety of materials and forms of construction have been used in the past for silos with varying degrees of success. They may be divided into four classes, as follows:

(1) Wooden silos;
(2) Metal silos;
(3) Monolithic concrete silos;
(4) Block and concrete stave silos.

The cost of construction and maintenance of a silo is a very important factor in deciding the type to purchase. This cost varies considerably, according to the type, classes two and three being by far the most expensive and class one the least. The following table gives approximate cost of silos of the various types of construction:

Brick—Solid Wall	$450 to $ 700
Brick—Air spaced hollow wall	650 to 1,200
Cement Block	450 to 800
Hollow Tile—Cement both sides	450 to 800
Stone*—Solid wall	485 to 800
Stone*—Double lined and air spaced	650 to 1,000
Concrete—Solid wall—monolithic construction	300 to 600
Concrete—Hollow wall—monolithic construction	650 to 1,000
Wooden Stave	200 to 300

These figures are based on silos of the same dimensions, and show wood to be the least expensive material.

The extensive use of the wooden silo has resulted in its being subjected to some of the most extreme tests. Its weaknesses have been carefully studied in an effort to eliminate all of its objectionable features and at the present time it is in very general use throughout the entire country.

There are very few species of wood which possess the necessary combination of qualities required for silo construction. Douglas fir is especially suited to this use since clear material is readily obtainable, the wood is durable and the staves are straight

* No value placed on stone except labor.

and strong. Probably more Douglas fir lumber is used annually in silo construction than any other species.

The objectionable features of the early wooden silos were shrinkage and decay. Shrinkage occurred during the warm dry summer weather, causing the staves to become loose and liable to collapse during heavy windstorms. This fault has been largely eliminated by the use of automatic adjustable hoops which keep a constant pressure on the walls of the silo.

CREOSOTED STAVE SILOS

The use of creosoted silo staves overcomes the difficulties of shrinkage in a different way. The presence of oil in the wood tends to minimize volume changes in the staves.

Decay has played a comparatively small part in reducing the life of the silo, except in cases where unsuitable species of wood have been used. Decay takes place most readily in wood that is subject to alternate wet and dry conditions. For this reason, creosoted lumber is desirable, since it retards the progress of decay, both by retarding moisture changes and by the antiseptic properties of the creosote.

The antiseptic qualities of creosote oil are well known and recognized. There have been considerable and varied claims made concerning the disastrous effect on the health of animals fed with silage from a creosoted silo. In order to determine the facts in the case, the U. S. Forest Products Laboratory at Madison, Wisconsin, recently conducted an investigation on this subject, and the following extract is taken from the report:

"While but few of the experiment stations had had any experience with creosoted silos, and only a small number of owners of such silos could be located, not a single case was reported where the silage had been damaged or the health or appetite of the stock affected. It was the general opinion of the experiment stations that no danger need be anticipated on this account."

With the present methods of treating Fir lumber it is possible to remove all excess or free oil from the wood, thereby eliminating "bleeding."

If it is not practicable to purchase a creosoted stave silo, a great deal of good may be accomplished by thoroughly painting the base of the staves and the joints between staves with hot coal-tar creosote. The expense of this operation is practically nil, and it will add several years to the life of a silo.

PAVING BLOCKS

Considerable original data have been collected regarding the effect of the various methods of treating upon the mechanical strength of the wood, and the total amount of shrinking and swelling which takes place in the wood when treated with different amounts of oil per cubic foot. The following specification provides a treatment which results in no material loss in strength of the fiber.

"The blocks shall be placed in the treating retort and a good grade of coal-tar creosote introduced and heated to approximately 215 degrees F. for two to four hours. The preservative shall then be drained off and a vacuum of 23 to 26 inches drawn to take out the surplus oil, vapors, gases, etc., from the wood cells. The vacuum shall then be broken by the introduction again of the preservative, which is then pressed into the wood at a temperature of 180 degrees F. until the blocks have received from 16 to 18 pounds of oil per cubic foot. After the blocks have received the required amount of oil, the pressure shall be released, and the temperature of the oil gradually raised to 215 to 230 degrees F., and held for one hour. This final heating expands the oil, vapors and gases within the wood, and causes a certain amount of the preservative to be expelled, due to this expansion, and also effects further seasoning of the wood. A final vacuum of 23 to 26 inches shall then be drawn, which dries the blocks of the surplus surface oil, leaving a thoroughly impregnated block which will never 'bleed' after being placed in the street, since it is forced to do its 'bleeding' during the treatment."

Figures obtained from tests on commercial material indicate the loss in strength of the fiber due to this treatment to be no more than 2 to 5 per cent, which, from a practical point of view, may be entirely neglected. The Association has done some careful experimenting to determine as nearly as possible what effects different amounts of oil have on the swelling and shrinking under extreme conditions. Results of these and other experiments indicate that the thoroughness of penetration plays an important part in reducing volume changes. For example, blocks treated with 17 pounds of oil per cubic foot, which amount is afterwards reduced to 12 pounds per cubic foot, have the same properties when put to the soaking test as blocks which are treated with 17 pounds of oil, all of which is left in the wood. The swelling takes place in the more lightly treated block at a slightly more

EXTREME WATER SOAKING TEST ON DOUGLAS FIR PAVING BLOCKS OF CREOSOTED AND NATURAL WOOD

Data secured by the Engineering Department of the West Coast Lumbermen's Association.

TABLE 34

	1	2		3				4				5				6	
Reference Number	Seasoning Condition of Blocks when Treated	Creosote Treatment Lbs. per Cu. Ft.		Immediately after Treatment				After Soaking in Water 66 Days				Removed from Soaking Tank and Air-Seasoned 69 Days				Total Change from Maximum after Soaking to Minimum after Re-drying Per Cent	
				Average Total Length of Blocks		Average Weight of Blocks		Average Total Length of Blocks		Average Weight of Blocks		Average Total Length of Blocks		Average Weight of Blocks			
		Gross	Net	Inches	Per Cent	Ounces	Per Cent	Inches	Per Cent Change	Ounces	Per Cent Change	Inches	Per Cent Change	Ounces	Per Cent Change	Average Total Length of Block	Average Weight of Block
1	Air-seasoned, 11% moisture.	14.4	9.4	6.808	100.0	15.9	100.0	7.037	3.36	19.9	25.5	6.899	1.34	16.0	0.64	2.02	24.5
2	Air-seasoned, 11% moisture.	22.3	16.6	6.906	100.0	19.2	100.0	7.173	3.86	26.5	38.0	7.031	1.81	19.4	1.04	2.05	37.0
3	Air-seasoned, 11% moisture.	20.7	15.1	6.919	100.0	18.8	100.0	7.197	4.01	26.2	39.4	7.050	1.90	18.9	0.53	2.11	38.8
4	Commercially Green, 30% moisture.	Natural wood		7.070	100.0	14.3	100.0	7.117	0.67	19.1	33.6	6.919	-2.14	13.1	-8.37	2.81	42.0
5	Commercially Green, 30% moisture.	14.1	9.9	6.992	100.0	18.9	100.0	7.088	1.37	23.9	26.5	6.930	-0.89	18.0	-4.76	2.26	31.2
6	Air-seasoned, 11% moisture.	Natural wood		6.868	100.0	13.0	100.0	7.121	3.68	19.6	50.8	6.932	0.93	13.3	2.31	2.75	48.5

— sign denotes loss as compared to corresponding figure, Column 3.

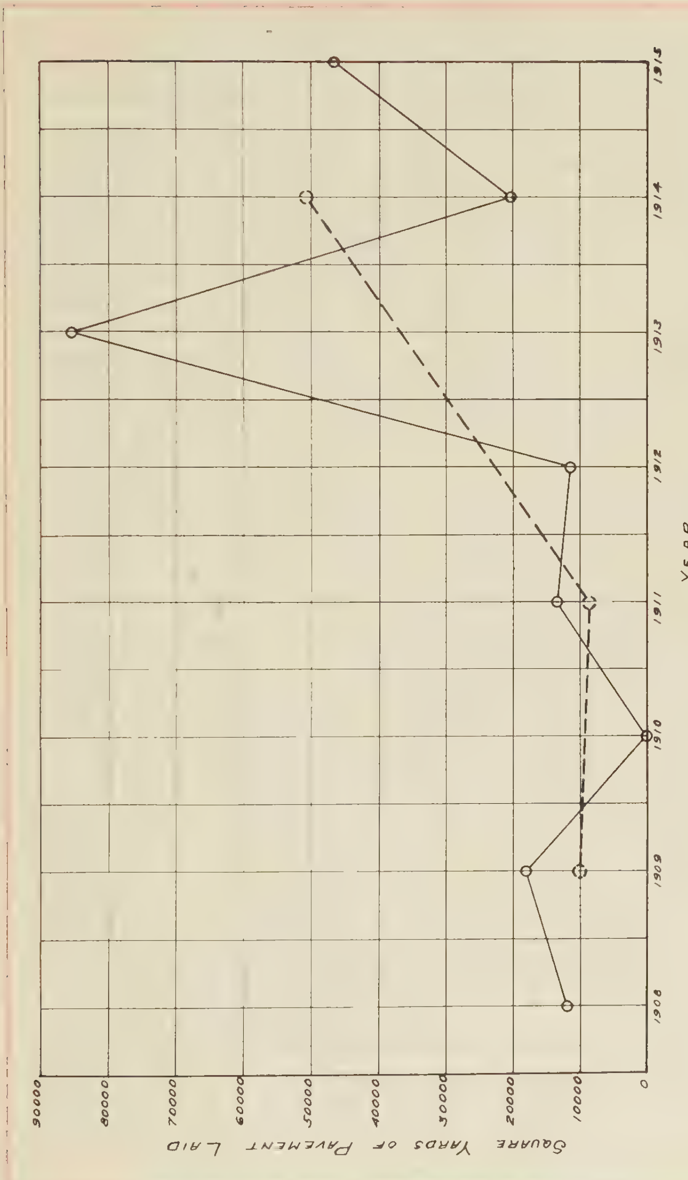


Diagram 21. Amount of creosoted Douglas fir paving blocks laid in Pacific Coast cities since the year 1908. Note marked increase in recent years.

rapid rate at first than in the block with the larger quantity of oil. In both cases it lasts through a long period of time. From a practical point of view, it is as easy to take care of the swelling in one case as in the other.

The material upon which the above mentioned tests were made, was selected to represent average commercial stock. Six planks were taken from as many logs and each cut into blocks. One block from each plank was used in each treatment shown in table 34. Due to this fact, the material in all treatments was similar and the results are comparable. It should be noted that the creosote treatment reduces the possible amount of swelling approximately 35 per cent. Comparing figures, column 6, under reference numbers 1 and 5, it will be seen that the total change in blocks treated green with approximately 14 pounds of oil is slightly greater than in air-seasoned blocks treated with the same amount of preservative. This is probably due to the fact that a less perfect coating of the cell walls is obtained with this amount of oil in the green blocks than in those seasoned before treatment, and indicates that green blocks should receive initial absorption of more than 14 pounds per cubic foot. The ideal treatment is to give a gross absorption sufficient to paint thoroughly the cell walls of the wood and afterwards reduce this absorption to 10 to 12 pounds per cubic foot. Blocks treated in this manner will be largely relieved of their tendency to shrink and swell and will not bleed under street conditions. Reducing the absorption in accordance with the above produces a better block at a lower cost. The treatment of blocks with 12 pounds per cubic foot as against 17 pounds represents a saving of approximately 15 cents per square yard, which, in view of the results, is worthy of consideration.

Creosoted Douglas fir paving blocks are gradually coming into more general use on the Pacific Coast. The City of Seattle up to 1915 had laid practically no wood block pavements. This city, together with the Port of Seattle Commission, laid more than 20,000 square yards of creosoted Douglas fir blocks in 1915. Diagram 21 shows the number of yards of creosoted wood blocks laid in Pacific Coast cities since 1908 and indicates the increased tendency to use this type of pavement.

FENCE POSTS AND POLES

Cedar is the most durable of Pacific Coast timber when used in the natural condition. Cedar posts or poles in normal locations are very durable; however, under certain adverse conditions, they succumb to the attack of fungus. Both red cedar and Douglas fir may be materially improved when used for poles and posts by giving them preservative treatment.

FENCE POSTS

Everyone is familiar with the decay characteristic in fence posts. The fungus, to thrive, must have food, warmth, moisture and air. Food and moisture are found in abundance in the wood. The other essentials are present through a large portion of the year in practically all climates in the United States. Rain soaks the ground all around the post and dries out slowly, thus making the moisture condition favorable for fungus growth, which accounts for its rapid development at this point.

The average layman has no conception as to the amount of lumber which is cut into fence posts annually. White oak, locust, Osage orange, and cedar have in the past stood at the head of the list in their ability to resist decay when used in a natural condition. Before preservation became so well established these species were used very largely for posts in all portions of the United States. The development of the creosoting industry, however, is changing past practice. When proper treatment is applied, all species are practically of equal durability. The following quotation is taken from U. S. Forest Service Circular No. 209, page 15, number 6:

"Species which, when untreated, decay most rapidly appear to give the greatest relative increase in service when treated. Loblolly pine, hemlock, beech and tamarack, which are the least resistant to decay when untreated, appear when treated to be equally as durable as treated longleaf pine, Spanish oak and white oak."

This makes it possible now to get good service out of wood which formerly would not have received any consideration. Experiments have been made on creosoted posts of some of the least durable woods found in the United States. These species have given good service for five years and are still sound. These

same posts, if set in a natural condition would have to be replaced on account of decay in two or three years. There is no question now but that a fence post when properly creosoted will last three to four times as long as a similar untreated post. This is particularly true of the less durable species.

The U. S. Forest Service has used a great many creosoted fence posts. Mr. Benedict, a forest supervisor at Hailey, Idaho, has recently used 500 lodgepole pine posts. This species is one of the least decay-resisting woods in the United States when used in a natural condition. The following quotation is taken from the March, 1915, number of "American Forestry," page 200, and shows what Mr. Benedict expects from treated lodgepole pine posts:

"In the ground, lodgepole pine untreated rots quickly. Given a bath in hot creosote from the bottom to a point above the ground line when set sufficiently to penetrate the outermost layers of the sapwood and all the openings through which decay could enter, the post should last from 12 to 20 years."

A Douglas fir heartwood post, without treatment, under conditions prevailing on the Pacific Coast, will last from five to six years. A similar post well creosoted, may be expected to last from 15 to 25 years.

If posts are creosoted, a smaller post may be used than is the usual custom. This is possible since it is not necessary to figure on the usual deterioration.

Creosoted posts do not require painting since the creosote gives the same effect as a brown stain. They can, however, if desired, be painted green, red or any dark color.

POLES

Poles, as in the case of posts, may be made durable by preservative treatment. Some poles are put up for temporary service and in such cases it would not be economy to treat them unless they would be removed and reset after serving in a temporary way. Poles for permanent use should, however, be given a thorough treatment before they are placed, which will give them fully twice the length of life secured from an untreated pole.

Figures 12 and 13, taken from U. S. Forest Service Bulletin No. 83, show an untreated Southern white cedar pole to be badly decayed after four years of service, and a creosoted loblolly pine pole with no sign of decay after 18 years.

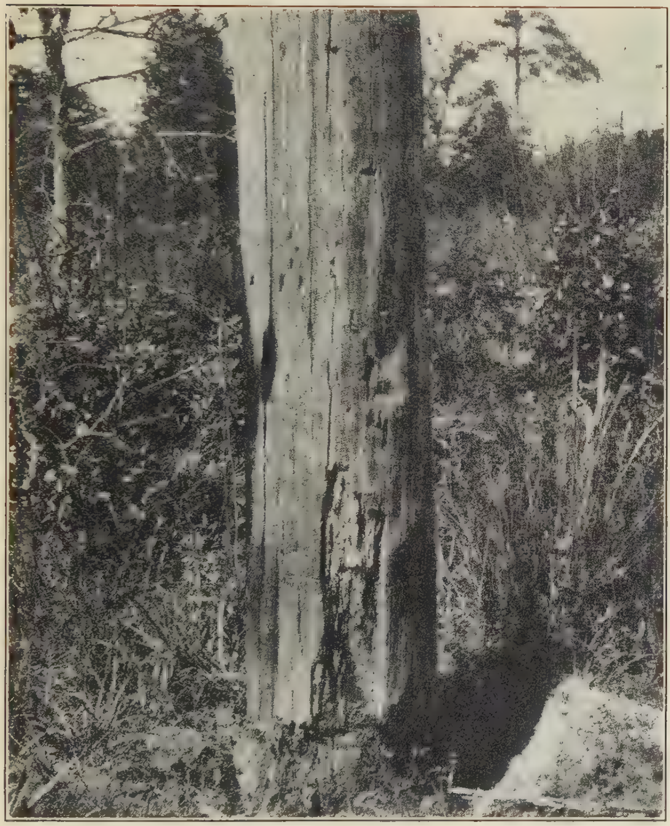


Fig. 12. Untreated pole of Southern White Cedar (Chamaecyparis Thyoides) after four years' service.

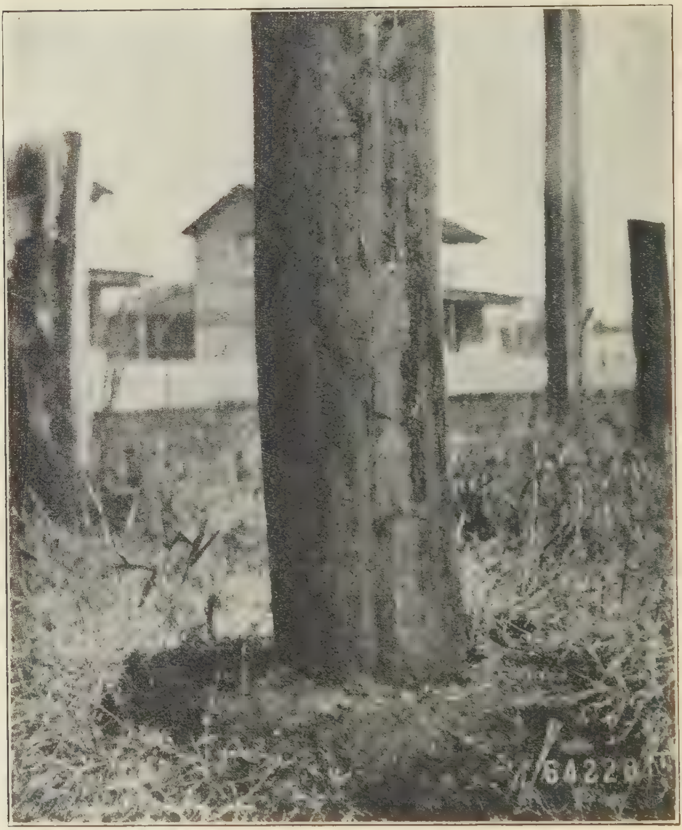


Fig. 13. Creosoted Loblolly pine pole after 18 years' service. No sign of decay.

The greatest profit will result from the use of treated poles in localities where the initial cost of the pole is high and also where replacements are expensive. Under such conditions, poles should never be placed without an efficient preservative treatment. In fact any pole which is intended for permanent service should have a butt treatment with creosote.

The following quotations are taken from page 40 of U. S. Forest Service Bulletin No. 84, and show the advisability of creosoting poles:

"Preservative treatment is profitable financially, the increased durability of the time decreasing the annual service charge. Relatively greater benefits are derived from the treatment of non-durable woods than from the treatment of those which possess great natural durability."

"Preservative treatment makes possible the use of poles of smaller butt circumference, since allowance usually made for deterioration by decay need not be considered, when it is certain that the full size and strength of the poles will be retained through a long period of years."

A creosoted pole line is much less apt to suffer damage from a sleet storm than one built of untreated poles, since untreated poles decay at the ground line, the point of greatest stress.

RED CEDAR SHINGLES

The physical characteristics of red cedar make it particularly adaptable to uses where durability and light weight are required, rather than tensile strength. Besides being practically immune from decay, this wood undergoes comparatively little shrinkage and swelling due to changes in moisture condition, and it holds paint well. The wood is soft and is not easily split by nails. These combined qualities place red cedar foremost as a shingle material. Approximately 85 per cent of Pacific Coast red cedar is manufactured into shingles.

The following method of laying red cedar shingles, taken, with slight changes, from the American Lumberman of November 27, 1915, unquestionably represents first-class practice.

CORRECT METHOD OF LAYING RED CEDAR SHINGLES

"The first essential is good Red Cedar shingles.

For rafters use sized 2x4s or 2x6s, spaced on not over two-foot centers, spiked solid and braced as load requires.

For roof boards or sheathing use good material. S1S strips 1x4 inches or random widths to not more than eight inches, spaced not more than two inches apart and nailed solid with 8d nails.

Preparation of Shingles. If they are to be stained use dry shingles, dipping each one in the stain not less than eight inches from butt. Shingles that are not to be stained should be wet thoroughly before laying.

If additional fire-resistant quality is wanted, dip in good quality of mineral paint or such other approved fire-resistant treatment as may be available.

Shingle Nail. Solid copper, solid zinc or hot-dipped zinc-coated nails preferred. Where these are not available use old-fashioned cut nails.

Size of Nail. For 5 to 2 inches or thinner shingles, 3d; for thicker shingles, 4d.

Laying the Shingles. Start at eaves and lay first coarse 2-ply, giving first course 2 inches projection over crown mold and 1-inch projection at gables.

On one-third or more pitch lay 16-inch shingles 4½ inches to the weather; on less than one-third pitch lay 16-inch shingles

4 inches to the weather. On one-third or more pitch lay 18-inch shingles 5½ inches to the weather; on less than one-third pitch lay 18-inch shingles 4½ inches to the weather.

Use a straight edge to make sure courses are laid straight. Break all joints at least 1¼ inches, seeing that no break comes directly over another on any three consecutive courses, thereby covering all nails.

Nail shingles 6 inches from butt (for 4½ inch lap) and ½-inch from sides, and put only two nails in each shingle. Shingle wider than 10 inches should be split.

Lay shingles so that water will run with the grain, and do not drive nail heads into shingles.

Lay wet shingles with butts close together. Leave ¼-inch space between dry shingles.

Use 14-inch galvanized iron, not less than 26-gauge, or best quality old-style tin, heavily coated, for valleys; copper or galvanized iron for ridge roll.

Use galvanized or heavily coated tin flashing around chimneys. If tin is used it should be painted two coats, one as soon as roof is completed and the second coat within two weeks. Galvanized metal should be painted two coats but should be given 30 days for oxidation before painting. No patent dryer or turpentine should be used.

Finish hips by laying a course of even width narrow shingles on both sides of hip over regular courses."

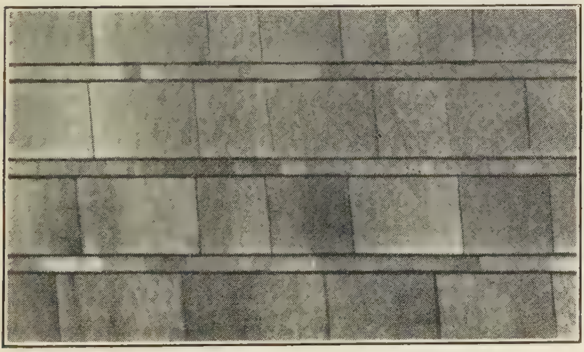


Fig. 14.

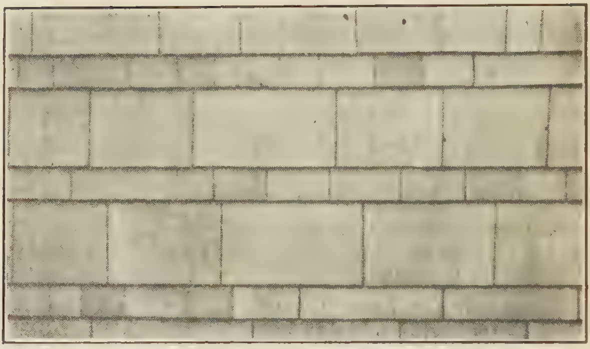


Fig. 15.

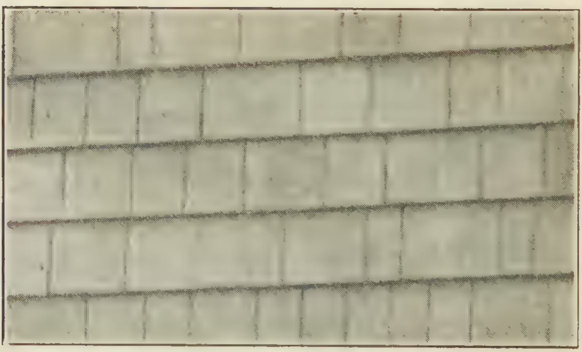


Fig. 16.

Fig. 17.

Figures 14 to 17 show four distinct styles of laying shingle siding.

GRADING RULES FOR SHINGLES

Some very decided improvements have recently been made in the grading of Red Cedar shingles. It is possible now for the purchaser to obtain branded shingles. This branding guarantees quality.

Grading Rules for Red Cedar Shingles Which Have Been in General Use Since 1908

Perfection. 18″. Variation of 1″, under or over, in length, allowed in 10 per cent. Random widths, but not narrower than 3″. When dry 20 courses to measure not less than 8¾″. To be well manufactured. Ninety-seven per cent to be clear, remaining 3 per cent admits slight defects 16″ or over from butt.

Puget A. 18″. Random widths, but not narrower than 2″. When dry, 20 courses to measure not less than 8¼″. Admits feather tips and 16″ shingles resulting from shims, and other defects 8″ or over from butt.

Eureka. 18″. Variation of 1″, under or over, in length allowed in 10 per cent. Random widths, but not narrower than 3″. When dry, 25 courses to measure not less than 9¾″. To be well manufactured. Ninety per cent to be clear, remaining 10 per cent admit slight defects 14″ or over from butt.

SKAGIT-A. 18″. Random widths, but not narrower than 2″. When dry, 25 courses to measure not less than $9\frac{1}{4}$″. Will admit feather tips, and 16″ shingles resulting from shims, and other defects 8″ or over from butt.

EXTRA CLEAR. 16″. Variation of 1″, under or over, in length, allowed in 10 per cent. Random widths, but not narrower than $2\frac{1}{2}$″. When dry, 25 courses to measure not less than $9\frac{1}{2}$″. To be well manufactured, 90 per cent to be clear, remaining 10 per cent admits slight defects 12″ or over from butt.

CHOICE A. 16″. Random widths, but not narrower than 2″. When dry, 25 courses to measure not less than 9″. Admits wane and 12″ shingles resulting from shims, and other defects 6″ or over from butt.

EXTRA *A*. 16″. Variation of 1″, under or over, in length allowed in 10 per cent. Random widths. But not narrower than 2″. When dry, 25 courses to measure not less than $7\frac{3}{4}$″. To be well manufactured. Eighty per cent to be clear, remaining 20 per cent admits defects 10″ or over from butt. If not to exceed 2 per cent (in the 20 per cent allowing defects 10″ from butt) shows defects closer than 10″, the shingles shall be considered up to grade.

STANDARD A. 16″. Random widths, but not narrower than 2″. When dry, 25 courses to measure not less than $7\frac{1}{2}$″. Admits wane and 12″ shingles resulting from shims, and other defects 6″ or over from butt.

PACKING

All shingles to be packed in regulation frame 20″ in width.

Openings shall not average more than $1\frac{1}{2}$″ to the course.

Perfection and Puget A shall be packed 20-20 courses to the bunch, 5 bunches to the M.

Eureka, Skagit A, Extra Clear, Choice A, Extra *A*, Standard A (dimension shingles excepted) shall be packed 25-25 courses to the bunch, 4 bunches to the M.

Dimension shingles (5″) shall be packed 24-24 courses to the bunch, 4 bunches to the M.

The character "M" indicates the multiple or unit by which red cedar shingles are bought and sold.

Every bunch shall be branded with full name of the grade as stated in these rules.

Color of wood and sound sap shall not be considered defects.

Percentage, when specified in these rules, applies in a general way to the total amount of shingles of like grade in a car.

Grading Rule Adopted by the Shingle Branch of the West Coast Lumbermen's Association for Shingles Bearing Rite-Grade Trademark

18″ Rite-grade perfects. Random widths but not narrower than 3″. When dry, 20 courses to measure not less than 8¾″. To be strictly clear and vertical grain and free from sap.

18″ Rite-grade selects. Random widths but not narrower than 3″. When dry, 20 courses to measure not less than 8¾″. Eighty per cent to be clear, remaining 20 per cent admits defects 12″ or over from butt. To be free from sap.

16″ Rite-grade perfects. Random widths but not narrower than 3″. When dry, 25 courses to measure not less than 9½″. To be strictly clear and vertical grain and free from sap.

16″ Rite-grade selects. Random widths but not narrower than 3″. When dry, 25 courses to measure not less than 9½″. Eighty per cent to be clear, remaining 20 per cent admits defects 10″ or over from butt. To be free from sap.

16″ Rite-grade perfects 6/2. Random widths, but not narrower than 3″. When dry, 25 courses to measure not less than 8″. To be strictly clear and vertical grain and free from sap.

16″ Rite-grade extra *A*. Random widths, but not narrower than 3″. When dry, 25 courses to measure not less than 8″. Eighty per cent to be clear, remaining 20 per cent admits defects 10″ or over from butt. To be free from sap.

16″ Dimensions rite-grade. 5″ wide. Made under specifications for above 16″ grades but must be strictly clear.

Packing

All shingles must be well manufactured.

18″ Rite-Grade shall be packed 20-20 courses to the bunch, 5 bunches to the M.

16″ Rite-Grade shall be packed 25-25 courses to the bunch, 4 bunches to the M.

Dimension Rite-Grade shall be packed 24-24 courses to the bunch, 4 bunches to the M.

All shingles to be packed in regulation frame 20″ in width. Band sticks not less than 19½″ long.

Openings shall not average more than 1½″ to the course.

Every bunch shall be branded with full name of the grade as stated in these rules.

Color of wood is not a defect.

All shingles to be packed in straight courses.

One inch under and over in length admitted.

Any shingle not over ¼″ off parallel shall be considered parallel.

Not over 4 per cent off grade admitted for discrepancy in inspection.

(Percentage, when specified in these rules, applies in a general way to the total amount of shingles of like grade in a car. The character "M" indicates the multiple or unit by which these shingles are bought and sold.)

SUBJECT INDEX